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[54] METHOD AND APPARATUS FOR SEAMLESS CONNECTIVITY OF WIDE-BAND NETWORKS AND NARROW-BAND NETWORKS

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[51] **Int. Cl.**[7] **H04N 7/10**; H04N 7/14

[52] **U.S. Cl.** **348/6**; 455/3.1; 455/3.2; 455/5.1; 455/6.1; 348/7; 348/12; 348/13; 379/90.01

[58] **Field of Search** 348/6, 7, 8, 10, 348/12, 13; 455/3.1, 4.1, 4.2, 5.1, 6.1, 6.2, 3.2; 379/90.01

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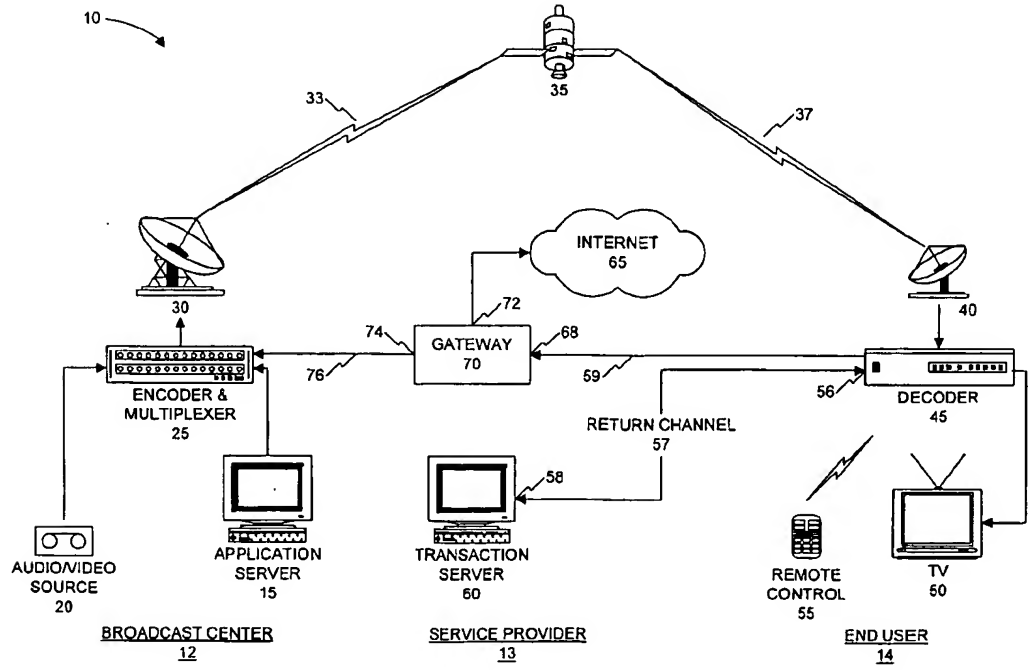
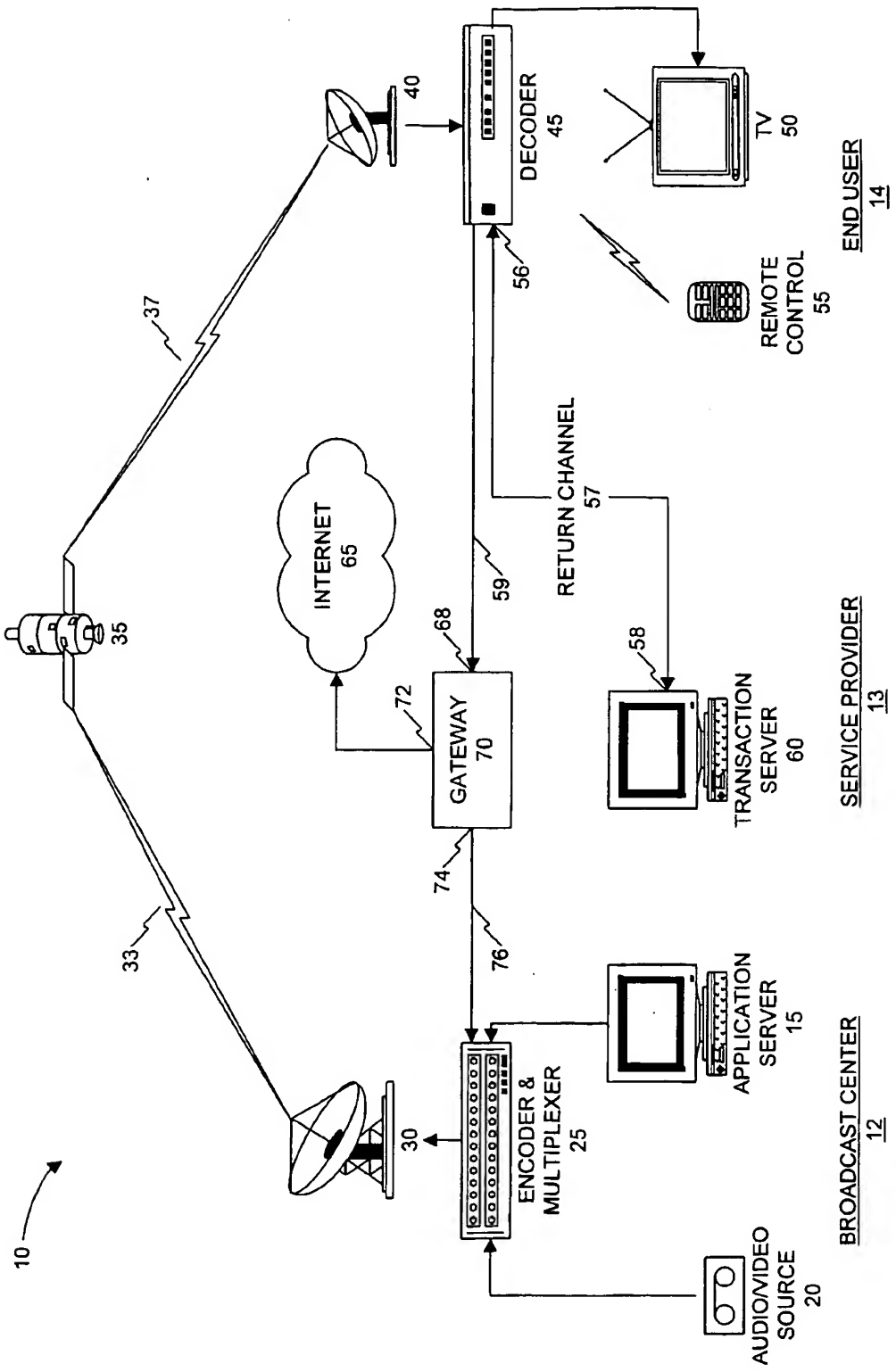
Primary Examiner—John K. Peng
Assistant Examiner—Linus H. Lo

[57] **ABSTRACT**

An apparatus for seamless connectivity between a narrow-band network like the Internet and an interactive TV wide-band network and methods of operating the same support on the fly translation and routing of data between the Internet and the interactive TV wide-band network. The apparatus for interfacing between a wide-band network and a narrow-band network comprises a decoder, having a decoder input, a first decoder port, and a second decoder port, which receives wide-band data from the wide-band network via the second decoder port and decodes the wide-band data to provide decoded data in response to decoder requests from the decoder input. A gateway, coupled to the decoder, the narrow-band network, and the wide-band network having a first gateway port to receive the decoder requests from the first decoder port, a second gateway port to interface with the narrow-band network, and a third gateway port to interface with the wide-band network, retrieves requested data from the narrow-band network in response to the decoder requests and transfers the requested data to the wide-band network for transfer to the decoder.

15 Claims, 3 Drawing Sheets




10
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DECODER
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TV
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56
REMOTE CONTROL
55
END USER
14
INTERNET
65
RETURN CHANNEL
57
59
68
72
GATEWAY
70
58
TRANSACTION SERVER
60
SERVICE PROVIDER
13
74
76
ENCODER & MULTIPLEXER
25
APPLICATION SERVER
15
BROADCAST CENTER
12
AUDIO/VIDEO SOURCE
20

FIG. 1

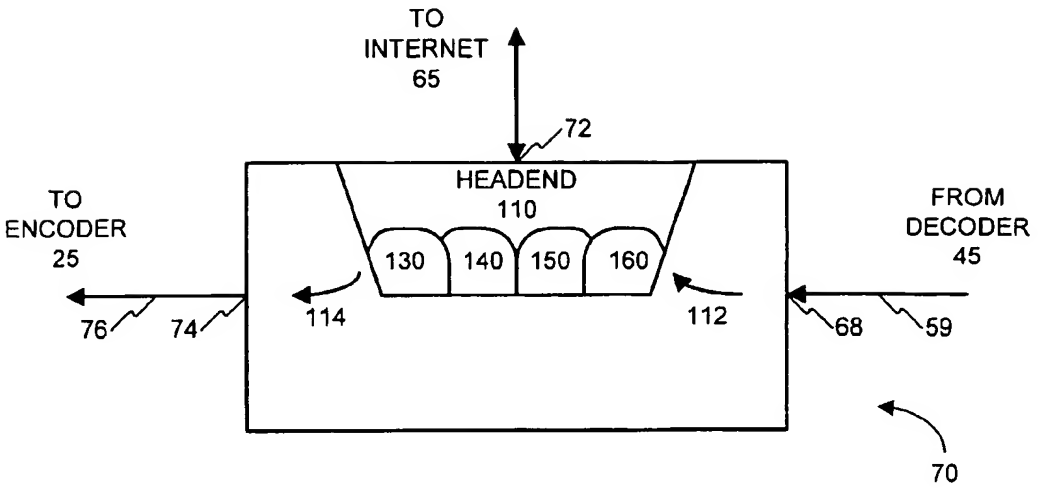
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FIG. 2

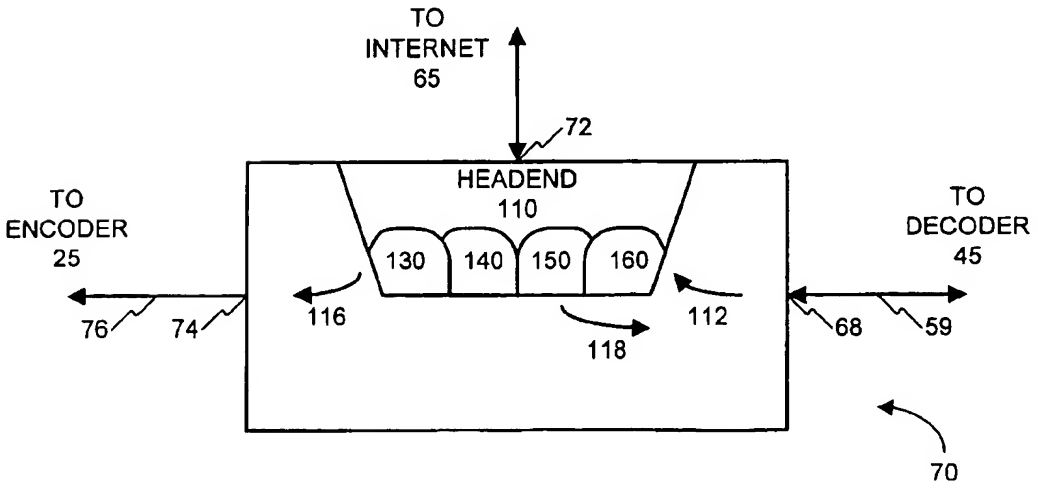
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FIG. 3

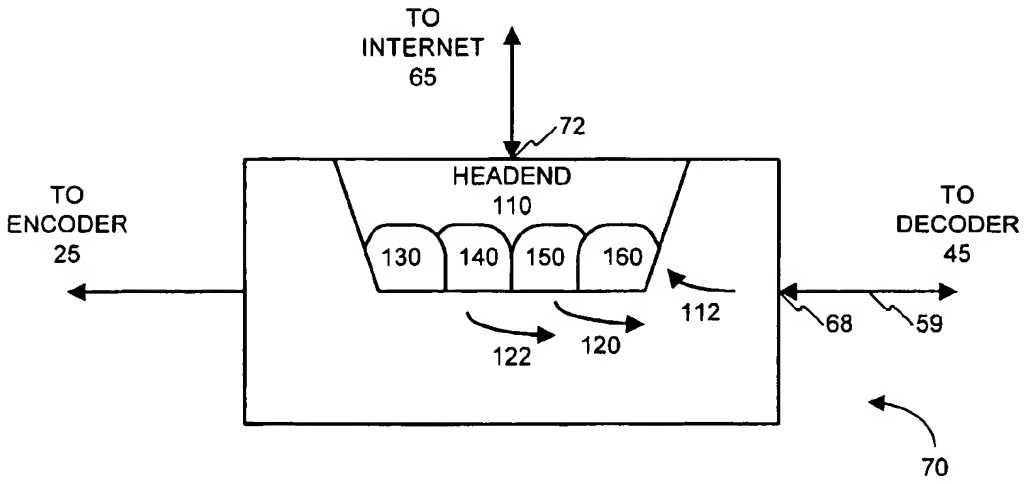
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FIG. 4

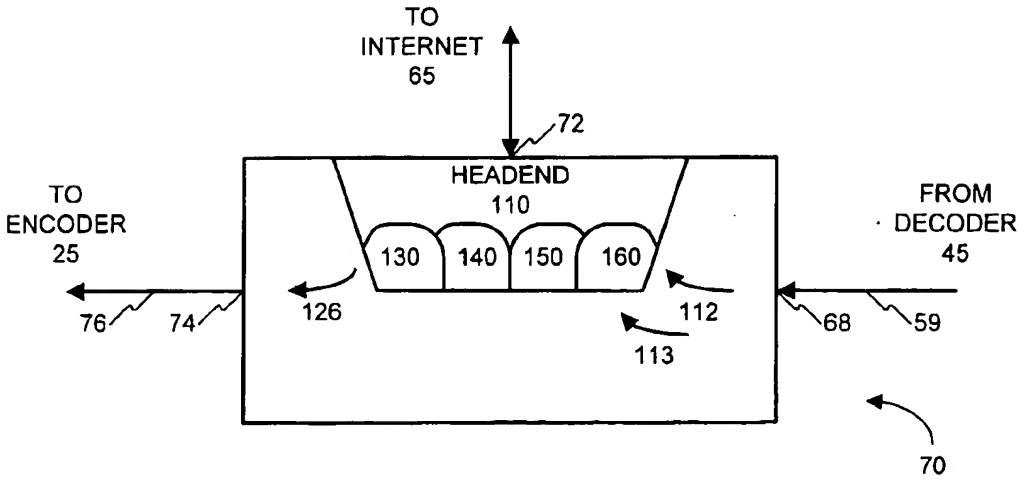
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FIG. 5

METHOD AND APPARATUS FOR SEAMLESS CONNECTIVITY OF WIDE-BAND NETWORKS AND NARROW-BAND NETWORKS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to interfacing a wide-band network with a narrow-band network and more particularly to transparently interface a unidirectional wide-band broadcast network and the Internet.

2. Description of the Related Arts

Currently, there are two dominant digital infrastructures that are widely accepted and in public use. The first is the Internet structure also known as the world wide web based on narrow-band networks, and the second is Digital Pay television (TV) networks such as DirectTV™ based on wide-band networks.

Being the two dominant digital infrastructures, a single super hybrid infrastructure would provide immense amount of information for its users. Users having access to the single super hybrid infrastructure would have limitless options available. However, no provisions have been made to converge the two infrastructures into a single super hybrid infrastructure. Moreover, considering the properties of each of these networks provides an understanding as to why the two infrastructure are not likely to converge into a single super hybrid infrastructure.

The Internet infrastructure relies on a backbone of limited bandwidth in view of the number of users and services that the Internet infrastructure supports. Users are typically limited to 28.8 kb/s (kilo bits/sec) accessing through telco lines. A fraction of the users are able to upgrade to cable modems capable of Mb/s (mega bits/sec) transfer rates. The terminals used to access the Internet possess high processing power and large amounts of storage. These terminals are commonly referred to as desktop computers. The terminal displays of these desktop computers also possess the ability to produce high quality pictures. In an effort to take advantage of the high processing power of the terminals and reduce bandwidth consumption of the Internet, programming for the Internet relies on large amounts of computer caching available at the terminals and are relying increasingly on distributed processing which downloads a portion of the processing into the terminal to complete the processing for accessing the various world wide web sites.

On the other hand, the wide-band network based Digital Pay TV networks relies on a wide-band broadcast monodirectional network combined with a point to point low bit rate (2400 bits/sec) bi-directional network. The terminals which receive the wide-band broadcast data possess low processing power and little to no storage medium. The displays coupled to the terminals are low quality interlaced displays such as a typical National Television Standards Committee (NTSC) TV found commonly in most households. Thus, the terminals available to the wide-band networks possess low processing power with virtually no storage medium for data and provide low quality displays compared to the Internet terminals.

Further advances based on the Digital Pay TV networks include interactive TV systems. In order to make interactive TV less costly and therefore more attractive to consumer acceptance, it is desirable to keep memory requirements in the receiver to a minimum. Thus, as development for interactive TV systems continues, the trend is to continue building terminals with low processing power and low storage requirements.

Contrary to the trend of maintaining low processing power and minimizing storage requirements, new Internet protocols that are being developed rely more on the processing power of the latest generation computers. Thus, as the Internet technology based on the narrow-band network develops and the interactive TV technology based on the wide-band network technology develops, the Internet technology and the interactive TV technology continues to alienate each other and move apart. Consequently, consumers seeking Internet access that subscribe to interactive TV are forced to acquire the latest generation computer. The cost of having both a subscription to interactive TV and the latest generation computer for Internet access can be cost prohibitive for the consumer. In order for the providers of interactive TV to supply a complete service, a transparent consumer interface between the wide-band network of interactive TV and the narrow-band network for the Internet is needed.

Therefore, it is desirable to provide Internet connectivity to low end terminals operating in an interactive TV wide-band network, and a method of operating the same that support on the fly translation and routing of data between the Internet and the interactive TV wide-band network for transparent access to the Internet.

SUMMARY OF THE INVENTION

The present invention provides an apparatus for seamless connectivity between the Internet and an interactive TV wide-band network and methods of operating the same which support transparent on the fly translation and routing of data between the Internet and the interactive TV wide-band network. The novel seamless connectivity between the networks is based on a gateway that provides the translation and routing of data. Thus, according to one aspect of the invention, a seamless connection for interfacing between a wide-band network and a narrow-band network comprises a decoder, having a decoder input, a first decoder port, and a second decoder port, which receives wide-band data from the wide-band network via the second decoder port and decodes the wide-band data to provide decoded data in response to decoder requests from the decoder input. A gateway, coupled to the decoder, the narrow-band network, and the wide-band network having a first gateway port to receive the decoder requests from the first decoder port, a second gateway port to interface with the narrow-band network, and a third gateway port to interface with the wide-band network, retrieves requested data from the narrow-band network in response to the decoder requests and transfers the requested data to the wide-band network for transfer to the decoder. The decoder receives the requested Internet data from the wide-band network.

According to one aspect of the invention, the seamless connection further comprises a display device having a display input which displays the requested data and wherein the decoder includes a third decoder port coupled to the display input to provide decoded requested data to the display device. Thus, the requested Internet data is displayed on the display device.

According to another aspect of the invention, the first decoder port includes a bi-directional port, and the first gateway port includes a bi-directional port. The gateway includes circuitry which parses the requested data to provide narrow-band data and wide-band data and transfers the narrow-band data for output to the first decoder port. The decoder receives the narrow-band data and decodes the narrow-band data for output to the display device. The gateway transfers the wide-band data to the wide-band

network. The decoder receives the wide-band data and recombines the wide-band data with the narrow band data for output to the display device. Thus, criteria may be established to efficiently determine the dynamic routing of the requested data between the wide-band network and the low bit rate network to the decoder. Criteria include the type of the requested Internet data, the availability of bandwidth, size of the Internet data, and added costs associated with transmitting using the wide-band network.

An apparatus and method for seamless connectivity between the Internet and an interactive TV wide-band network are provided. The gateway supports a high performance computer for executing the native protocols of the Internet. The gateway parses the Internet data which enables the low processing power decoders to process the Internet data for display. Thus, lower cost decoders with low processing power can function to provide Internet access.

Other aspects and advantages of the present invention can be seen upon review of the figures, the detailed description, and the claims which follow.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 illustrates a system level block diagram for digital transmissions in a direct broadcast satellite system for a wide-band network.

FIG. 2 illustrates a block diagram of an embodiment of a gateway transferring Internet data via the wide-band network according to the present invention.

FIG. 3 illustrates a block diagram of another embodiment of the gateway transferring Internet data via the wide-band network and the communication channel according to the present invention.

FIG. 4 illustrates a block diagram of another embodiment of the gateway transferring Internet data via the communication channel according to the present invention.

FIG. 5 illustrates a block diagram of another embodiment of the gateway transferring a plurality of Internet data for repeated broadcasts via the wide-band network according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The invention will be described with respect to the Figs. in which FIG. **1** generally shows a digital transmission system, as for example a direct broadcast satellite system. It is presumed that a single satellite transponder accommodates a plurality of respective TV programs in time division multiplexed format.

Referring to FIG. **1**, the direct broadcast satellite system **10** provides a wide-band network that includes a broadcast center **12**, service provider **13**, and an end user **14**. The broadcast center **12** includes an application server **15**, an audio/video source **20**, encoder and multiplexer **25**, and satellite transmitter **30**. The application server **15** controls execution of interactive TV applications which are loaded into the logic circuits of the application server **15** to perform a series of specifically identified operations dictated by the interactive TV applications.

The interactive TV applications include associated audio and video information sources **20** The application server **15** synchronizes the interactive TV applications and the associated audio and video information sources **20** into transport packets that provide inputs to the encoder and multiplexer **25**. The encoder and multiplexer **25** receives the transport packets and encodes the transport packets for transmission. Satellite transmitter **30** time-multiplexes the transport packets and transmits the transport packets as upload signal **33** to satellite **35**.

The broadcast center **12** is described in detail in issued U.S. Pat. No. 5,448,568 entitled "System of Transmitting an Interactive TV Signal" assigned to Thomson Consumer Electronics, Inc. issued Sep. 5, 1995. The U.S. Pat. No. 5,448,568 is herein incorporated by reference in its entirety.

Satellite **35** receives the upload signal **33** and transmits download signal **37** to end user **14**. The end user **14** includes satellite dish **40**, decoder **45**, TV **50**, remote control **55**, return channel **57**, and communication channel **59**. Satellite dish **40** receives the download signal **37** and provides an output to decoder **45**. The decoder **45** includes a software operating system loaded into the logic circuits of the decoder **45** that performs a series of steps to control the operations of the decoder **45**. The decoder **45** receives the download signal **37** from satellite dish **40** and decodes the transmitted interactive TV application and its associated audio and video information **20**. The decoder **45** executes the interactive TV application and provides audio and video outputs to TV **50**.

Remote control **55** provides inputs to the decoder **45** to select execution of other interactive TV applications for output to TV **50**. The decoder **45** includes an input/output port **56** that couples to the return channel **57** for communication to transaction server **60** or the communication channel **59** for communication with gateway **70**.

The service provider **13** provides local interaction with the end user **14** and includes the transaction server **60** and the gateway **70**. The transaction server **60** includes an input/output port **58** which couples to the return channel **57**. The transaction server **60** provides monitoring of transactions performed by the end user **14** and updating of the software operating system for the decoder **45** via the return channel **57**. The gateway **70** includes a port **68** which receives request for Internet data from decoder **45** via the communication channel **59**. The return channel **57** and the communication channel **59** may be telephone lines or cable lines and support a low bit rate link.

The gateway **70** includes a port **72** which provides access to Internet **65**. The Internet **65** is a narrow-band network commonly known as the world wide web. The gateway **70** retrieves Internet data from the Internet **65** and communicates the Internet data to port **74** of the gateway **70**. High speed line **76** transfers the Internet data to the encoder and multiplexer **25** which encodes the Internet data for broadcast to the wide-band network. Decoder **45** receives the encoded Internet data and decodes the Internet data for display on TV **50**.

FIG. **2** illustrates a block diagram of an embodiment of the gateway **70** according to the present invention. The gateway **70** includes a headend **110** that includes circuitry programmed to execute native protocols of the Internet **65**. The headend **110** includes an MPEG (Motion Picture Experts Group) encoder **130**, renderer **140**, cache **150**, and parser **160**. Port **68** of the gateway **70** receives a data request **112** from decoder **45**. Communication channel **59** transfers the data request **112** from the decoder **45** to the port **68**. Communication channel **59** is a low bit rate link utilizing telephone lines as the medium for data transfers from the decoder **45** and the gateway **70**. The gateway **70** receives the data request **112** for Internet data and forwards the data request **112** to the headend **110**.

The headend **110** executes the native protocols for the data request **112** and receives Internet data **114** from the Internet **65**. The cache **150** manages latency between the

Internet web servers and the headend **110** during retrieval of Internet data **114**. The headend **110** transfers the Internet data **114** to port **74** where the high speed line **76** transfers the Internet data **114** to the encoder and multiplexer **25** for encoding. The Internet data **114** includes spatial and temporal correlation encoded data such as rendered MPEG encoded audio and video data. The MPEG encoder **130** and renderer **140** provides the rendered MPEG graphical data. The Internet data **114** is encoded for broadcast by the satellite **30** to the wide-band network. The decoder **45** receives the encoded Internet data and decodes the Internet data for display by TV **50**.

Given that the MPEG encoder **130** and render **140** process the Internet data **114**, the decoder **45** does not require high processing power to render the graphical data from the Internet data **114**. The headend **110** provides a simple and high quality graphical interface to the Internet. Flexibility in MPEG encoding and rendering is also achieved. Moreover, the nature of MPEG encoding takes advantage of changes in relation to static portions of a page. Once the static portions of a page is transferred, later transfers provide data that represent changes to the static portions of the page. Thus, various tradeoffs are considered for the transfer of the MPEG data to the decoder such as fixed quality encoding with variable latency or variable quality with fixed latency. Other tradeoffs include fixed bandwidth verses variable bandwidth allocation of the wide-band link. The tradeoffs are taken into account for minimizing the processing of Internet data for the decoder **45**.

FIG. **3** illustrates a block diagram of another embodiment of the gateway **70**. The gateway **70** includes a headend **110** that includes circuitry programmed to execute native protocols of the Internet **65**. Port **68** of the gateway **70** receives a data request **112** from decoder **45**. Communication channel **59** transfers the data request **112** from the decoder **45** to the port **68**. Communication channel **59** is a low bit rate link utilizing telephone lines as the medium for data transfers between the decoder **45** and the gateway **70**. The gateway **70** receives the data request **112** for Internet data and forwards the data request **112** to the headend **110**.

The headend **110** executes the native protocols for the data request **112** and receives Internet data **114** from the Internet **65**. The parser **160** parses the Internet data **114** into wide-bard data and narrow-band data such as graphical data and textual data. The headend **110** determines routing of the parsed Internet data between the wide-band links and the narrow-band links based on criteria such as cost, availability of bandwidth, size of data, and type of data. For example, small sized data may be transferred using the slower low bit rate link. Real time data on the other hand such as video or audio data are transferred using the faster wide-band network.

Referring to FIG. **3**, the gateway **70** receives the wide-band Internet data **116** and transfers the wide-band Internet data **116** to port **74** where the high speed line **76** transfers the wide-band Internet data **116** to the encoder and multiplexer **25** for encoding. After encoding the wide-band Internet data **116**, satellite **30** broadcasts the encoded Internet data to the wide-band network. The gateway **70**, in response to the narrow-band data **118**, transfers the narrow-band Internet data **118** to port **68** where the communication channel **59** transfers the narrow-band Internet data **118** to the decoder **45**. The decoder **45** receives the encoded wide-bard Internet data **116** from the wide-band network and the narrow-band Internet data on communication channel **59**. **25** After decoding the encoded wide-band Internet data **116**, the decoder **45** includes circuitry which recombines the wide-band Internet data **116** with the narrow-band Internet data **118** to provide display data for display by TV **50**.

The decoder **45** includes circuitry that renders the graphical data for display by TV **50**. Bandwidth consumption of the wide-band network is reduced by parsing the internet data to provide graphical data and textual data and using the narrow-band network to transfer the parsed internet data.

FIG. **4** illustrates another embodiment of the gateway **70** according to the present invention. As decoder **45** receives a request to access the Internet **65**, the decoder tunes to a specific channel on the wide-band network and downloads an interactive TV application associated with Internet access. The interactive TV application includes an Internet web browser similar to the Netscape Navigator™ developed by Netscape Communications Corporation and instruction codes that programs circuitry within the decoder **45** to establish the communication channel **59** to contact the gateway **70**. Thus, the decoder **45** includes additional circuitry for increased processing power that enables execution of a world wide web browser at the decoder **45**.

As the decoder **45** receives inputs for Internet requests **112**, the Internet requests **112** are transferred to port **68** of the gateway **70** via the established communication channel **59**. The gateway **70** transfers the Internet requests **112** to the headend **110**. The headend **110** includes circuitry programmed to retrieve the requested Internet data. Once the requested Internet data is retrieved, the headend **110** parses the Internet data to provide text **120** and control devices **122** for the particular web page. The control devices **122** include functional buttons and scrolling functions for the web page.

The gateway **70** transfers the text **120** and the control devices **122** to the decoder **45** via communication channel **59**. The text **120** and the control **25** devices **122** provide inputs to the Internet web browser which enables the decoder **45** to reconstruct the requested Internet data. As the decoder **45** request additional web pages, the headend **110** transfers additional text **120** and control devices **122** associated with the additional web pages via the communication channel **59**. Thus, as the decoder possesses more processing power, the amount of data and the rate of transfer for the data to support Internet browsing is reduced.

FIG. **5** illustrates another embodiment of the gateway **70** according to the present invention. During instances when requests for access to the Internet **65** are abundant, certain web pages on the Internet **65** are more popular and are repeatedly requested. The headend **110** includes the cache **150** and circuitry programmed to statistically monitor and store repeated retrievals of the more popular web pages from the Internet **65**. Data from the statistical monitoring establish controls for rebroadcasting the more popular web pages to the wide-band network. Rebroadcasting the more popular web pages enables faster responses to decoders **45** that request those web pages.

For example, Internet requests **112** and **113** request similar Internet data and are received at port **68** via Communication channel **59** from a plurality of decoders **45**. The gateway **70** forwards the Internet requests **112** and **113** to the headend **110**. The headend **110** retrieves the requested Internet data **126** and determines that the Internet data is frequently requested and notifies the headend **110**. As the headend **110** transfers the requested Internet data **126** to port **74** for transfer to the encoder **25** via the high speed line **76**, the encoder **25** is also notified that the requested Internet data **126** is to be rebroadcasted. The encoder **25** encodes the requested. Internet data **126** for broadcast by the satellite **30** and notifies the satellite to repeatedly broadcast the encoded

internet data. The satellite **30**, in response to the notification, rebroadcasts the requested Internet data **125** received from cache **150** at regular intervals. Increased decoder response is achieved by having the popular web pages stored in cache **150** and regularly broadcasted rather than having each individual decoder submit requests to the gateway **70** to retrieve the same popular web pages.

In a further embodiment of the invention, the decoder **45** includes circuitry programmed to select particular web pages that have been requested from the repeated broadcasts of the popular web pages. The other web pages received from the wide-band network are filtered and ignored by the decoder **45**. Thus, the decoder **45** is programmed to select from the popular web pages broadcasted onto the wide-ban(i network those web pages that the decoder **45** had requested. Rebroadcasting the popular web pages enables the gateway **70** to operate at higher efficiency by avoiding repeated accesses to Internet **65**. Furthermore, latency associated with accessing the Internet **65** is reduced by having the popular web pages readily download able from the wide-band network. Depending on the traffic for accessing particular web pages, latency associated with accessing the particular web pages can be of long duration. Thus, repeated broadcasts of popular web pages from the Internet **65** increases response time to the decoder **45** when accessing the Internet.

Accordingly, an apparatus for seamless connectivity of wide-band networks and narrow-band networks has been provided. The gateway provides an interface between the wide-band network and the narrow-band network. Accessing the Internet which resides on the narrow-band network from the wide-band network base is transparent to the users of the decoder on the wide-band network. Depending on the type of Internet data and the sophistication of the circuitry of the decoder, the Internet data is transferred over the wide-band network or the low bit rate communication channel of the decoder or a combination of both. Although the embodiments for seamless connectivity of wide-band networks and narrow-band networks have been disclosed with reference to an interactive TV system operating in a satellite transceiving network and the Internet, variations of the seamless connectivity interface according to the present invention are applicable in other network applications.

The foregoing description of a preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obviously, many modifications and variations will be apparent to the practitioners skilled in the art. It is intended that the scope of the invention be defined by the following claims and their equivalents.

What is claimed is:

1. A seamless connection for interfacing between a wide-band network and a narrow-band network comprising:

a decoder, having a decoder input, a first decoder port, and a second decoder port, which receives wide-band data from the wide-band network via the second decoder port and decodes the wide-band data to provide decoded data in response to decoder requests from the decoder input;

a gateway, coupled to the the coder, the narrow-band network, and the wide-band network having a first gateway port to receive the decoder requests from the first decoder port, a second gateway port to interface with the narrow-band network, and a third gateway port to interface with the wide-band network, which retrieves requested data from the narrow-band network in response to the decoder requests and transfers the requested data to the wide-band network for transfer to the decoder; and

a display device having a display input which displays the requested data and wherein the decoder includes a third decoder port coupled to the display input to provide decoded requested data to the display device;

wherein:

the first decoder port includes a bi-directional port;

the first gateway port includes a bi-directional port;

the gateway includes circuitry which parses the requested data to provide narrow-band data and wide-band data and transfers the narrow-band data to the first gateway port for output; and

the decoder receives the narrow-band data via the first decoder port.

2. The seamless connection according to claim **1**, wherein:

the gateway transfers the wide-band data to the wide-band network; and

the decoder receives the wide-band data and recombines the wide-band data with the narrow band data for output to the display device.

3. A seamless connection for interfacing between a wide-band network and a narrow-band network comprising:

a decoder, having a decoder input, a first decoder port, and a second decoder port, which receives wide-band data from the wide-band network via the second decoder port and decodes the wide-band data to provide decoded data in response to decoder requests from the decoder input;

a gateway, coupled to the decoder, the narrow-band network, and the wide-band network having a first gateway port to receive the decoder requests from the first decoder port, a second gateway port to interface with the narrow-band network, and a third gateway port to interface with the wide-band network, which retrieves requested data from the narrow-band network in response to the decoder requests and transfers the requested data to the wide-band network for transfer to the decoder; and

a display device having a display input which displays the requested data and wherein the decoder includes a third decoder port coupled to the display input to provide decoded requested data to the display device;

wherein the decoder includes circuitry programmable to execute specified functions receives a browser application from the wide-band network which programs the circuitry in the decoder to receive parsed Internet data from the narrow-band network for output to the display device.

4. The seamless connection according to claim **3**, wherein the gateway receives Internet data pertaining to a particular web page and parses the web page to provide the parsed Internet data for transfer to the decoder.

5. The seamless connection according to claim **4**, wherein the parsed Internet data includes text and control devices to reconstruct the particular web page.

6. A connection system for a wide-band broadcast network for accessing a narrow-band network to provide Internet access comprising:

a wide-band receiver, coupled to the wide-band network, which receives broadcasts of encoded wide-band broadcast data from the wide-band network;

a decoder, coupled to the wide-band broadcast network having a first decoder input, a second decoder input, a

first decoder port, and a second decoder port, responsive to decoder control signals applied to the first decoder input provides decoder requests to the first decoder port and decodes wide-band data received from the second decoder input to provide display data to the second decoder port;

a gateway, coupled to the decoder and the narrow-band network having a first gateway port to receive the decoder requests, a second gateway port to transceive Internet data, and a third gateway port, which retrieves requested Internet data from the narrow-band network in response to the decoder requests and transfers the requested Internet data to the third gateway port;

an encoder, coupled to the third gateway port having an encoder input to receive the requested Internet data and an encoder output, which encodes the requested Internet data and provides the encoded wide-band broadcast data to the encoder output;

a wide-band transmitter, coupled to the wide-band network and the encoder output, which broadcasts the encoded wide-band broadcast data to the wide-band network; and

a display coupled to the second decoder port which receives the display data and provides an visual image in response to the display data;

wherein:

the gateway includes circuitry which parses the requested Internet data to provide narrow-band data and wide-band data and transfers the narrow-band data for output to the first decoder port and the wide-band data to the encoder input; and

the decoder receives the narrow-band data and the encoded wide-band broadcast data and includes circuitry which recombines the narrow-band data and the encoded wide-band broadcast data to provide display data to the second decoder port.

7. A connection system for a wide-band broadcast network for accessing a narrow-band network to provide Internet access comprising:

a wide-band receiver, coupled to the wide-band network, which receives broadcasts of encoded wide-band broadcast data from the wide-band network;

a decoder, coupled to the wide-band broadcast network having a first decoder input, a second decoder input, a first decoder port, and a second decoder port, responsive to decoder control signals applied to the first decoder input provides decoder requests to the first decoder port and decodes wide-band data received from the second decoder input to provide display data to the second decoder port;

a gateway, coupled to the decoder and the narrow-band network having a first gateway port to receive the decoder requests, a second gateway port to transceive Internet data, and a third gateway port, which retrieves requested Internet data from the narrow-band network in response to the decoder requests and transfers the requested Internet data to the third gateway port;

an encoder, coupled to the third gateway port having an encoder input to receive the requested Internet data and an encoder output, which encodes the requested Internet data and provides the encoded wide-band broadcast data to the encoder output;

a wide-band transmitter, coupled to the wide-band network and the encoder output, which broadcasts the encoded wide-band broadcast data to the wide-band network; and

a display coupled to the second decoder port which receives the display data and provides an visual image in response to the display data;

wherein:

the decoder includes circuitry programmable to execute specified functions receives a browser application from the wide-band network which programs circuitry in the decoder to receive parsed Internet data from the narrow-band network for output to the display device.

8. The connection system according to claim **7**, wherein the gateway includes circuitry which provides internet browsing to retrieve the requested Internet data from the narrow-band network and parse the requested Internet data to provide the parsed Internet data to the decoder.

9. The connection system according to claim **8**, wherein the gateway requested Internet data includes a particular web page and the parsed Internet data includes text and control devices to reconstruct the particular web page.

10. A connection system for a wide-band broadcast network for accessing a narrow-band network to provide Internet access comprising:

a wide-band receiver, coupled to the wide-band network, which receives broadcasts of encoded wide-band broadcast data from the wide-band network;

a decoder, coupled to the wide-band broadcast network having a first decoder input, a second decoder input, a first decoder port, and a second decoder port, responsive to decoder control signals applied to the first decoder input provides decoder requests to the first decoder port and decodes wide-band data received from the second decoder input to provide display data to the second decoder port;

a gateway, coupled to the decoder and the narrow-band network having a first gateway port to receive the decoder requests, a second gateway port to transceive Internet data, and a third gateway port, which retrieves requested Internet data from the narrow-band network in response to the decoder requests and transfers the requested Internet data to the third gateway port;

an encoder, coupled to the third gateway port having an encoder input to receive the requested Internet data and an encoder output, which encodes the requested Internet data and provides the encoded wide-band broadcast data to the encoder output;

a wide-band transmitter, coupled to the wide-band network and the encoder output, which broadcasts the encoded wide-band broadcast data to the wide-band network; and

a display coupled to the second decoder port which receives the display data and provides an visual image in response to the display data;

wherein:

the gateway retrieves a plurality of web pages from the narrow-band network and transfers the plurality of web pages to the encoder;

the encoder encodes the plurality of web pages and provides encoded wide-band web page broadcast data to the wide-band transmitter; and

the wide-band transmitter transmits the wide-band web page broadcast data to the wide-band network.

11. The connection system according to claim **10**, wherein the decoder includes circuitry programmed to select particular web pages from the wide-band web page broadcast data for decoding to provide display data for output.

12. A method of seamless connectivity on a hybrid network for interfacing between a wide-band network and a narrow-band network comprising the steps:

interfacing to the narrow-band network to retrieve narrow-band data in response to decoder requests;

encoding the narrow-band data for transfer to the wide-band network;

decoding wide-band data from the wide-band network to provide display data; and

parsing the narrow-band data to provide low bit rate data and wide-band data.

13. A method of seamless connectivity on a hybrid network for interfacing between a wide-band network and a narrow-band network comprising the steps:

interfacing to the narrow-band network to retrieve narrow-band data in response to decoder requests;

encoding the narrow-band data for transfer to the wide-band network;

decoding wide-band data from the wide-band network to provide display data;

parsing the narrow-band data to provide low bit rate data and wide-band data;

transferring the low bit rate data to a low bit rate link;

receiving the low bit rate data from the low bit rate link; and

recombining the low bit rate data with the wide-band data to provide the display data.

14. A method of seamless connectivity on a hybrid network for interfacing between a wide-band network and a narrow-band network comprising the steps:

interfacing to the narrow-band network to retrieve narrow-band data in response to decoder requests;

encoding the narrow-band data for transfer to the wide-band network;

decoding wide-band data from the wide-band network to provide display data;

parsing the narrow-band data to provide low bit rate data and wide-band data;

downloading a client browser application from the wide-band network;

parsing the narrow-band data to provide low bit rate data to the client browser application; and

processing the low bit rate data to provide the display data.

15. The method of seamless connectivity according to claim **14**, wherein:

the low bit rate data includes image rectangles representing optional wide-band data;

transferring the optional wide-band data to the wide-band network; and

recombining the optional wide-band data with the low bit rate data of the client browser application to display the optional wide-band data in response to a decoder request.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO : 6,118,472

DATED : Sep. 12, 2000

INVENTOR(S): Dureau, et al.

It is certified that an error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In claim 1 (at column 7, line 61), replace "the the coder" with --the decoder--.

Signed and Sealed this

Twenty-fourth Day of April, 2001

Attest:

Nicholas P. Godici

NICHOLAS P. GODICI

Attesting Officer

Acting Director of the United States Patent and Trademark Office

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(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2002/0087694 A1

Daoud et al. (43) Pub. Date: Jul. 4, 2002

(54) APPARATUS AND METHOD FOR IDENTIFYING A REQUESTED LEVEL OF SERVICE FOR A TRANSACTION

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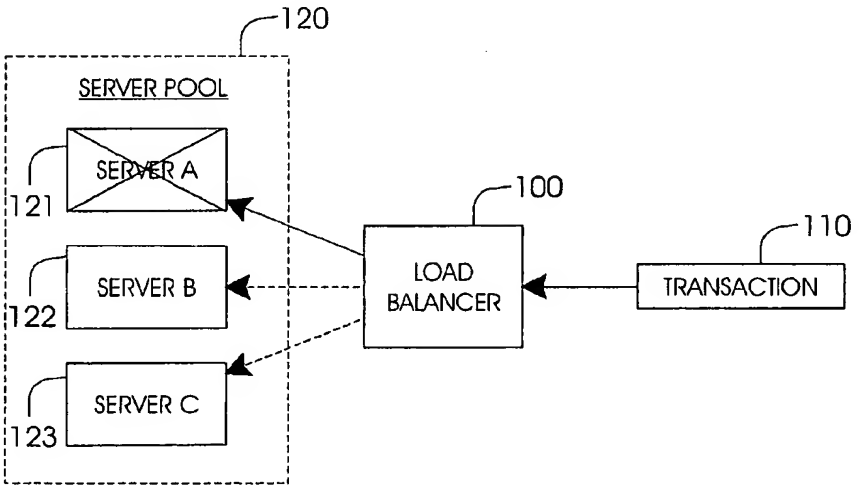
(52) U.S. Cl. 709/226; 709/203

(57) ABSTRACT

An apparatus for identifying a requested level of service for a transaction wherein the transaction may be processed in accordance with the requested level of service. The invention is preferably embodied in computer readable program code stored in suitable storage media, and comprises, program code for selecting the requested level of service for the transaction, and program code for assigning the requested level of service to the transaction. The transaction is preferably a packetized signal comprising at least a data packet having a service tag associated therewith, wherein the service tag includes the requested level of service. The requested level of service can be any suitable factors or combination thereof, and can be assigned at any point on the network. The service tag is read from the transaction using suitable program code (e.g., at a load balancer), and based on the requested level of service, the transaction is directed to and processed by a network device that is best able to provide the requested level of service.



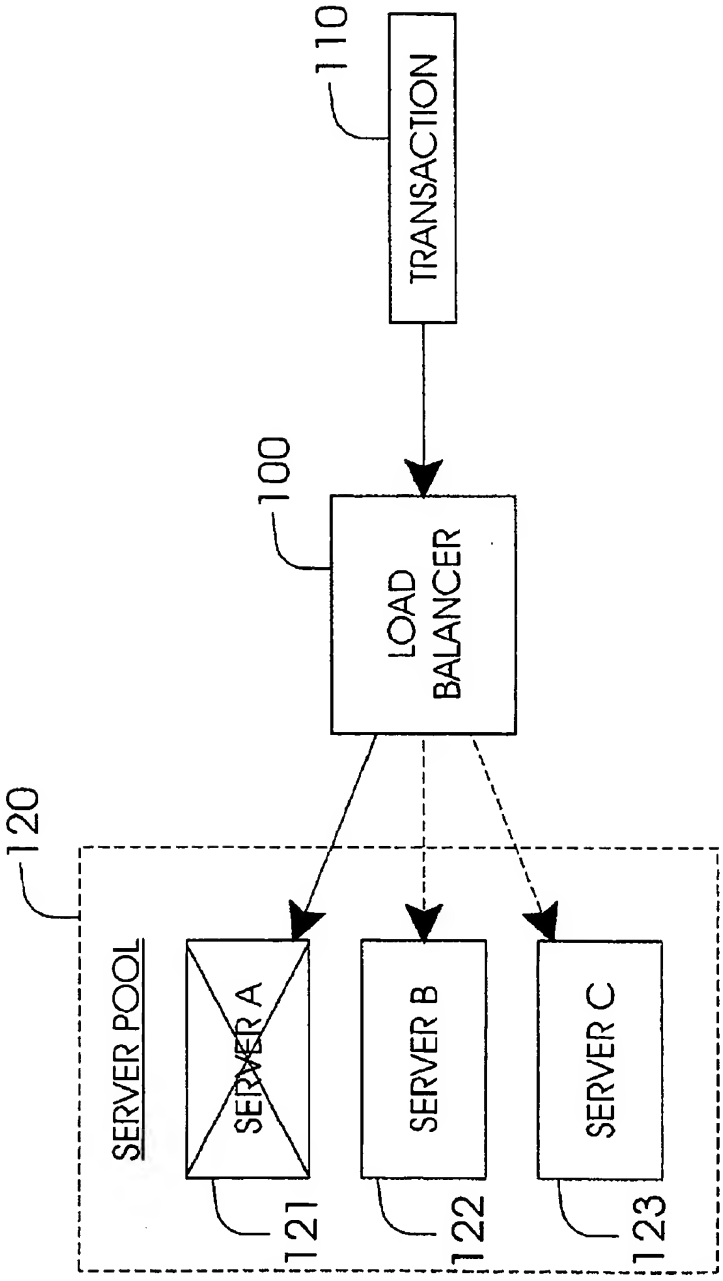

110
TRANSACTION
100
LOAD BALANCER
120
SERVER POOL
SERVER A
SERVER B
SERVER C
121
122
123

FIG. 1

FIG. 2

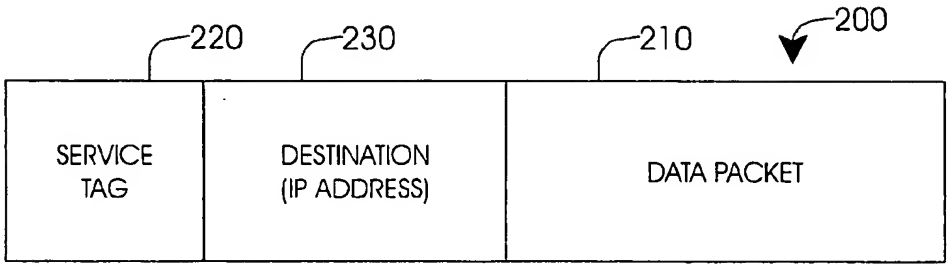


FIG. 4

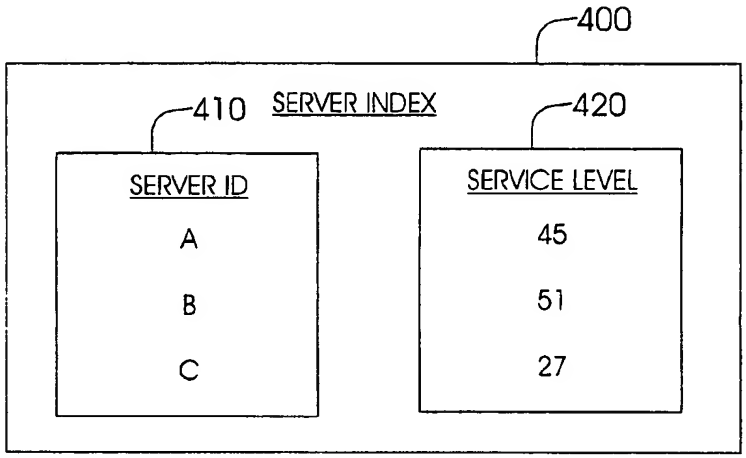
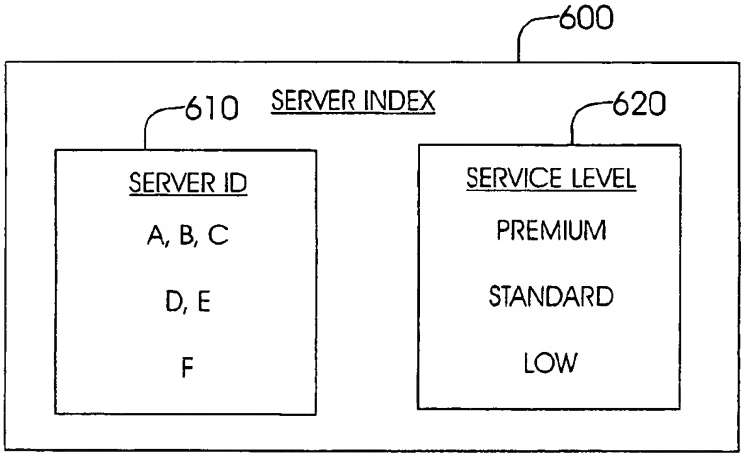


FIG. 6



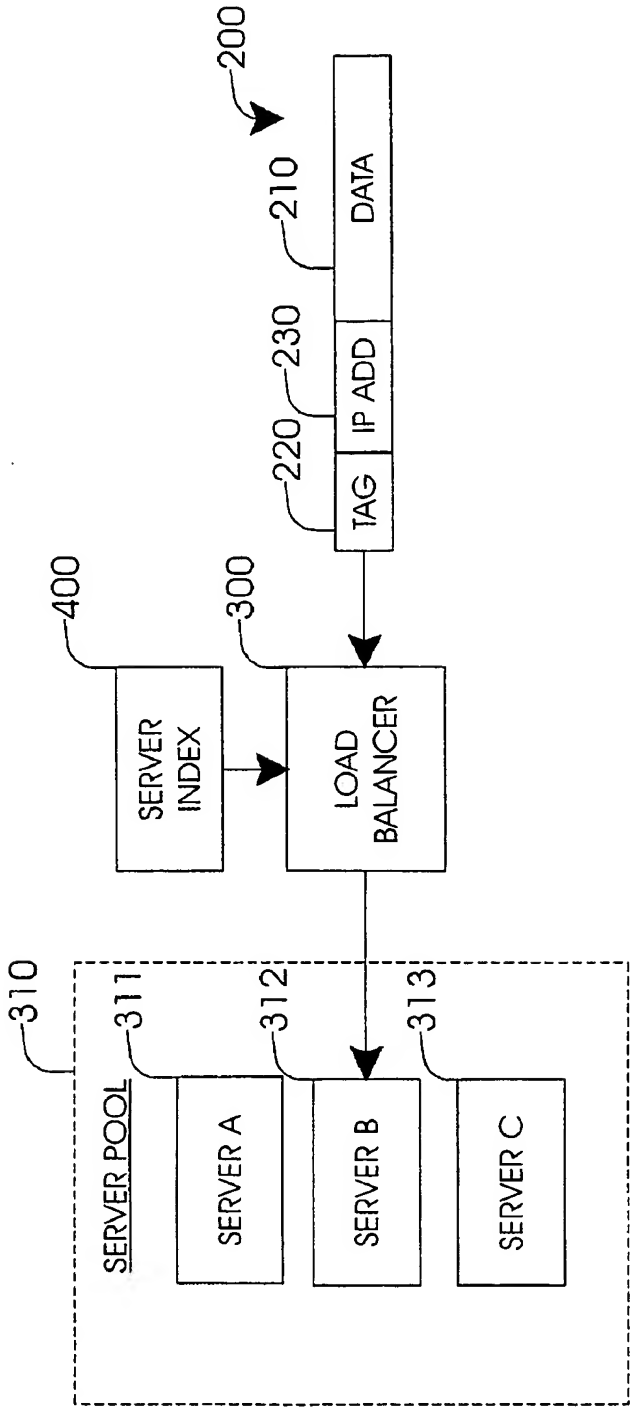

200
210
DATA
230
IP ADD
220
TAG
400
300
SERVER INDEX
LOAD BALANCER
310
311
312
313
SERVER POOL
SERVER A
SERVER B
SERVER C

FIG. 3

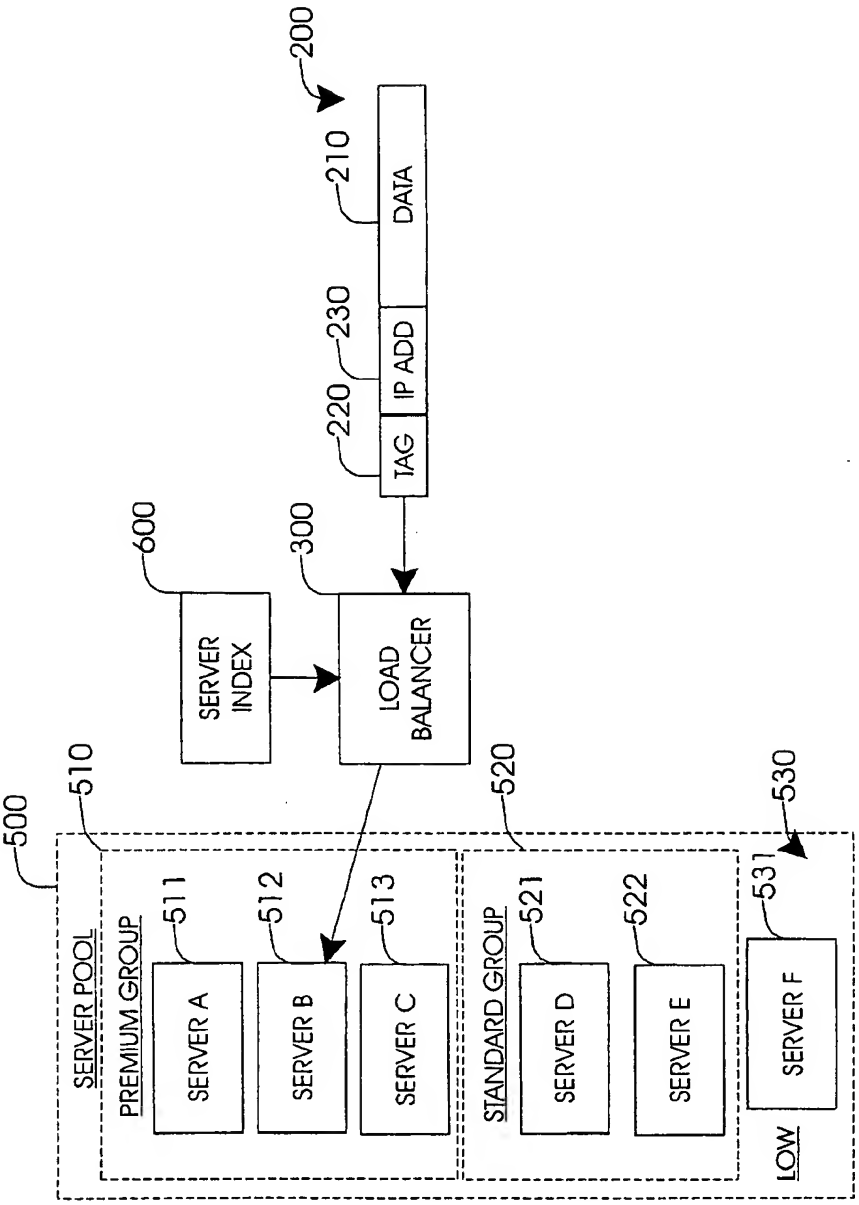

200
210
DATA
230
IP ADD
220
TAG
600
300
SERVER INDEX
LOAD BALANCER
500
510
520
530
SERVER POOL
PREMIUM GROUP
511
512
513
SERVER A
SERVER B
SERVER C
STANDARD GROUP
521
522
SERVER D
SERVER E
531
SERVER F
LOW

FIG. 5

FIG. 7

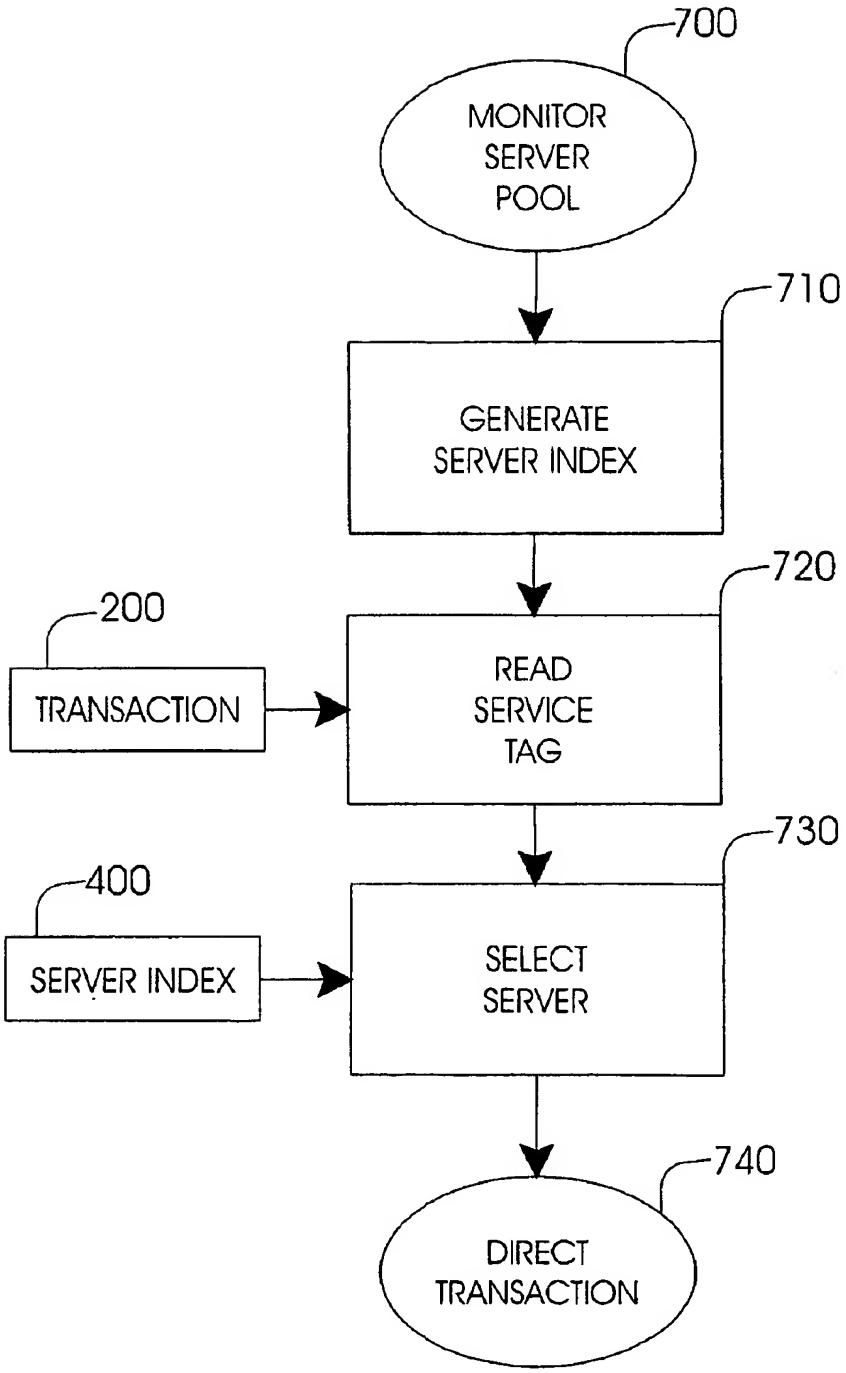
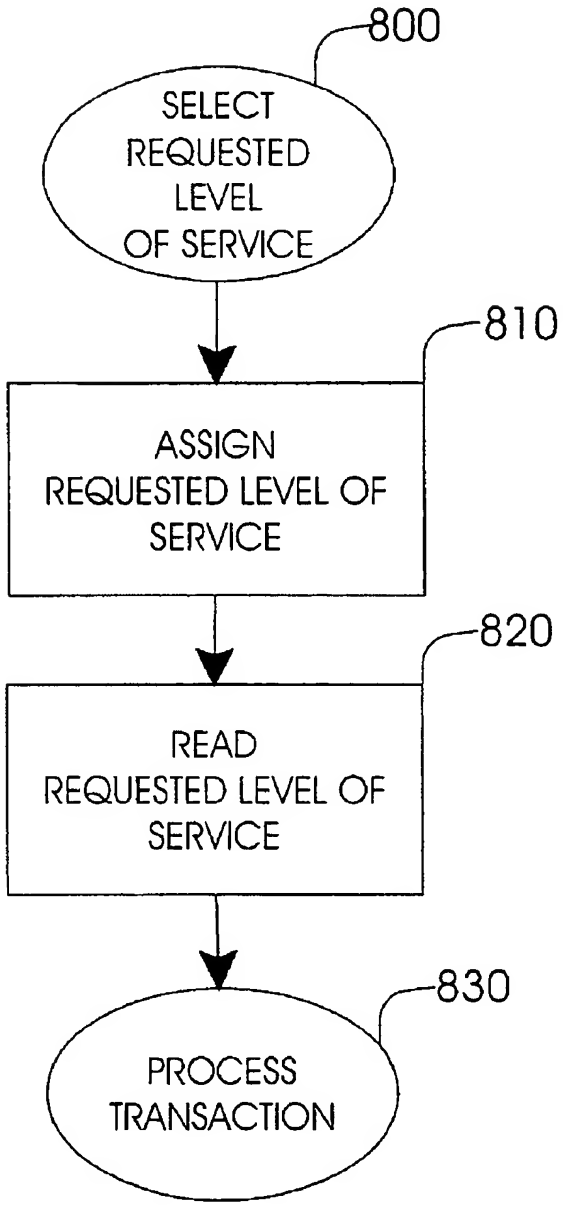

700
MONITOR SERVER POOL
710
GENERATE SERVER INDEX
720
200
TRANSACTION
READ SERVICE TAG
730
400
SERVER INDEX
SELECT SERVER
740
DIRECT TRANSACTION

FIG. 8


800
SELECT REQUESTED LEVEL OF SERVICE
810
ASSIGN REQUESTED LEVEL OF SERVICE
820
READ REQUESTED LEVEL OF SERVICE
830
PROCESS TRANSACTION

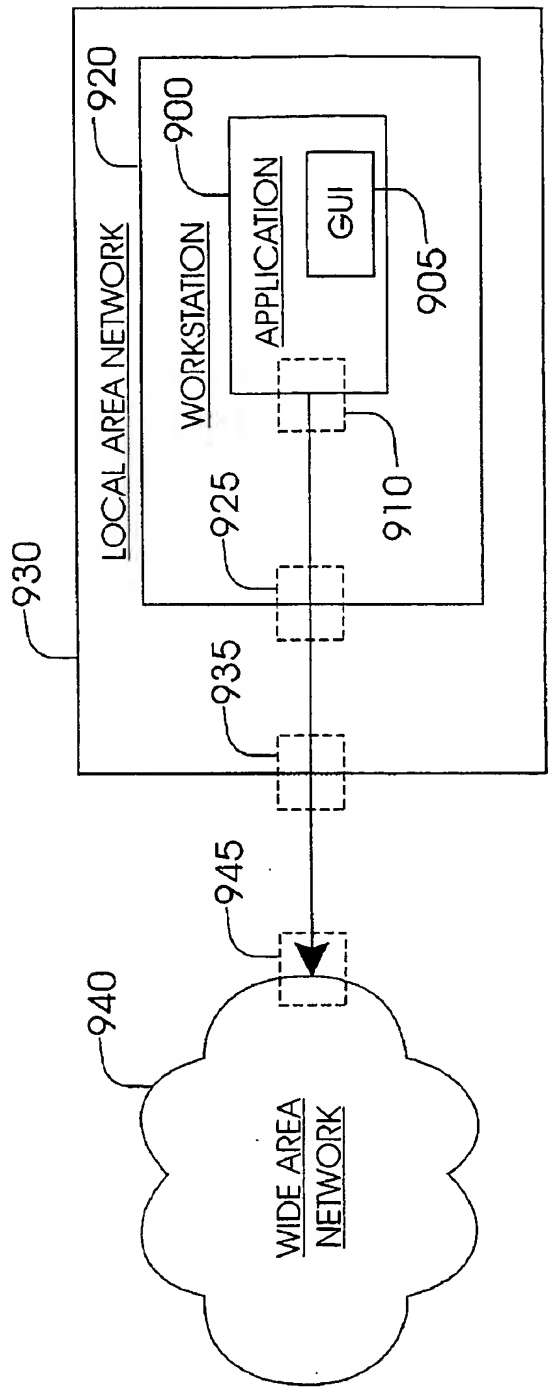

920
900
LOCAL AREA NETWORK
WORKSTATION
APPLICATION
GUI
905
910
925
930
935
945
940
WIDE AREA NETWORK

FIG. 9

APPARATUS AND METHOD FOR IDENTIFYING A REQUESTED LEVEL OF SERVICE FOR A TRANSACTION

RELATED APPLICATION

[0001] This patent application is related to co-owned patent application for APPARATUS AND METHOD FOR ROUTING A TRANSACTION BASED ON A REQUESTED LEVEL OF SERVICE, having the same filing date and identified by Hewlett Packard Docket No. HP 10002670-1.

FIELD OF THE INVENTION

[0002] The invention pertains to identifying a requested level of service for a transaction, wherein the transaction may be processed in accordance with the requested level of service.

BACKGROUND OF THE INVENTION

[0003] Server pools having multiple servers are often provided on networks, including the Internet, to handle large volumes of transactions (i.e., "requests to process data") thereon. Load balancing tools are used to direct incoming transactions to the server in the server pool in such a way that the traffic is balanced across all the servers in the pool. As such, the transactions can be processed faster and more efficiently.

[0004] One approach to load balancing simply involves routing each new transaction to a next server in the server pool (i.e., the "round-robin" approach). However, this approach does not distinguish between available servers and those which are down or otherwise unavailable. Therefore, transactions directed to unavailable servers are not processed in a timely manner, if at all. Other approaches to load balancing involve routing transactions to the next available server. That is, an agent monitors a pool of servers for failure and tags servers that are unavailable so that the load balancer does not route transactions to an unavailable server. However, this approach is also inefficient, still not necessarily routing transactions to the server that is best able to process the transaction. For example, a large transaction (e.g., a video clip) may be directed to a slow server even though there is a faster server available, because the slow server is identified as being the "next available" server when the transaction arrives at the load balancer. Likewise, a low priority transaction (e.g., an email) may be directed to the fast server simply based on the order that the servers become or are considered available.

[0005] A more current approach uses a combination of system-level metrics to route transactions and thus more efficiently balance the incoming load. The most common metrics are based on network proximity. For example, the 3/DNS load balancing product (available from F5 Networks, Inc., Seattle, Wash.) probes the servers and measures the packet rate, Web-request completion rate, round-trip time and network topology information. Also for example, the Resonate Global Dispatch load balancing product (available from Resonate, Inc., Sunnyvale, California) uses latency measurements for load balancing decisions.

[0006] However, while system metric approaches measure server characteristics, the transaction is not routed based on service levels required by or otherwise specific to the transaction. That is, the transaction is not routed based on the transaction size, the originating application, the priority of the transaction, the identification of the user generating the transaction, etc. Instead, the transaction is routed to the fastest available server when the transaction arrives at the load balancer. As such, the video clip and the low priority email, in the example given above, still may not be efficiently routed to the servers for processing. For example, if the low priority email arrives at the load balancer when the fastest server is available, the email will be routed to the fastest server, thus leaving only slower servers available when the high priority video clip later arrives at the load balancer.

[0007] Likewise, transactions are often directed to other network devices (e.g., routers, servers, storage devices, etc.) based merely on an IP address. Again, such an approach may not be the most efficient when routing transactions from different applications, users, at different times, etc.

SUMMARY OF THE INVENTION

[0008] The inventors have devised a method and apparatus for identifying a requested level of service for a transaction wherein the transaction may be processed in accordance with the requested level of service.

[0009] The invention is preferably embodied in computer readable program code stored in suitable storage media, and comprises program code for selecting the requested level of service for the transaction, and program code for assigning the requested level of service to the transaction. Preferably, the transaction is a packetized signal having at least a data packet (e.g., the data to be processed), and a service tag including the requested level of service.

[0010] The requested level of service can be based on any suitable factors, and can be assigned at any point on the network. For example, the service tag can indicate the requested level of service as a predefined service category (e.g., premium, standard, low), a user identification (e.g., user1, user2, administrator), a transaction type (e.g., email, video), etc. Also for example, the service tag can be user-defined, set by the application submitting the transaction, set by an administrator, based on the time (e.g., weekday or weekend), based on the type of transaction, etc. Or for example, the requested level of service may be user-defined (e.g., using commands or strings of commands) via a suitable user interface. Or the requested level of service may be based on a combination of factors. For example, a transaction may include a requested level of service and a backup level of service, wherein the transaction is directed to the network device based on the backup level of service when the requested level of service is unavailable.

[0011] The service tag is read from the transaction using suitable program code (e.g., at a load balancer). Based on the requested level of service, the transaction is directed to a network device (e.g., a server) that is best able to provide the requested level of service for processing the transaction. For example, where the requested level of service associated with the transaction is a scale value of "50", the load balancer selects the server providing a corresponding service level nearest the requested level of service, such as a scale value of "48". Alternatively, the transaction can be processed by a server within a group of servers wherein each

server best provides the requested level of service. For example, a category of service can be requested, such as "premium", and the load balancer thus selects any server from the group of servers providing a corresponding service level of "premium".

[0012] As such, the transaction is efficiently routed to a server based on service level information specific to the transaction. Thus for example, a low priority transaction (e.g., an email) may arrive at the load balancer before a high priority transaction (e.g., a video clip) when the fastest server is available. However, the low priority transaction is identified as such and routed to a slower server. Thus, the fastest server is available when the high priority transaction arrives at the load balancer, even so it arrives later than the low priority transaction.

[0013] These and other important advantages and objectives of the present invention will be further explained in, or will become apparent from, the accompanying description, drawings and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] Illustrative and presently preferred embodiments of the invention are illustrated in the drawings in which:

[0015] **FIG. 1** shows a first embodiment of a load balancer for routing a transaction to a server;

[0016] **FIG. 2** shows a packetized transaction having a service tag associated therewith for requesting a level of service for the transaction;

[0017] **FIG. 3** shows a second embodiment of a load balancer for routing the transaction of **FIG. 2** to a server based on the requested level of service indicated by the service tag;

[0018] **FIG. 4** illustrates a server index identifying servers and the corresponding service level of each server that can be used by the load balancer in **FIG. 3**;

[0019] **FIG. 5** shows a load balancer routing the transaction of **FIG. 2** to a server within a group of servers each best able to provide the requested level of service indicated by the service tag;

[0020] **FIG. 6** illustrates a server index identifying groups of servers and the corresponding service level of each group that can be used by the load balancer in **FIG. 5**;

[0021] **FIG. 7** is a flow chart showing a method for routing the transaction of **FIG. 2** to a server, as in **FIG. 3** and **FIG. 5**;

[0022] **FIG. 8** is a flow chart showing a method for identifying a requested level of service for a transaction for processing in accordance with the requested level of service; and

[0023] **FIG. 9** illustrates various points of a system where the service tag may be assigned to the transaction.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0024] **FIG. 1** shows a load balancer **100** for routing a transaction **110** to a number of (i.e., one or more) servers **121, 122, 123** in a server pool **120**. For purposes of illustration, Server A is unavailable as indicated by the "X" in **FIG. 1**. Using a simple "round-robin" approach, the load balancer **100** receives a next transaction **110** and directs the transaction **110** to the next server in the server pool **120** (i.e., the last server to have received a transaction). For example, where the previous transaction is directed to server **123** (Server C), the next server is server **121** (Server A) even where the server **121** (Server A) is unavailable as shown in **FIG. 1**, and so forth. Alternatively, the load balancer **100** directs the transaction **110** to the next available server in the server pool **120**. That is, an agent (e.g., suitable program code) monitors each of the servers **121, 122, 123** in the server pool **120** and labels a server that has failed, shut down, or is otherwise unavailable, as "unavailable" (e.g., using a suitable computer readable tag). Thus, the load balancer **100** recognizes a server that has been labeled "unavailable" and does not route transactions to the unavailable server. For example, where the previous transaction was directed to server **123** (Server C) and server **121** (Server A) is indicated as being "unavailable", the next server is server **121** (Server A). However, the next available server is server **122** (Server B). Therefore, in this example the transaction **110** is directed to server **122** (Server B). Alternatively, the load balancer **100** can direct the transaction **110** to the "fastest" available server in the server pool **120**. For example, where server **121** (Server A) generally provides a fast turn-around but is labeled "unavailable", server **122** (Server B) provides a medium turn-around, and server **123** (Server C) provides a slow turn-around, the transaction **110** is routed to server **122** (Server B). That is, although server **121** (Server A) is generally the fastest server in the server pool **120**, server **121** (Server A) is unavailable, therefore leaving server **122** (Server B) as the fastest available server. However, none of these approaches direct the transaction **110** to a server **121, 122, 123** based on parameters specific to the transaction **110**.

[0025] **FIG. 2** shows a packetized transaction **200**. The packetized transaction **200** includes a data packet **210** (i.e., the data to be processed) and a service tag **220**. The data packet **210** can include any data that is to be processed in any number of ways. For example, the data packet **210** can include an email message to be delivered to a recipient, a uniform resource locator (URL) requesting a hypertext markup language (HTML) page from the corresponding Internet site, data to be stored in a network area storage (NAS) device, spreadsheet data for tabulation, a portion thereof to be reassembled upon reaching the network device, etc. Optionally, the transaction **200** can also include additional fields. For example, the transaction **200** can include a destination field **230**, such as a device on the network indicated or identified by an IP address.

[0026] The service tag **220** is preferably a single or multi-bit packet associated with the data packet **210**, the value of which identifies a requested level of service for the transaction **200**. However, the service tag **220** and the requested service level identified therein can take any suitable form. The service tag **220** can be a numeric value. For example, the service tag **220** may be a single bit such as a "one", indicating high priority, or a "zero", indicating low priority. Or for example, the service tag can be a number on a scale of one to ten, with each number indicating a level of service. Alternatively, the service tag **220** can indicate the requested level of service as a predefined service category. For example, the requested level of service can be indicated as premium, standard, or low. Likewise, the service tag **220**

can indicate the requested level of service as a specific parameter. For example, the service tag **220** can indicate the processing speed or capacity required or desired for the transaction **200**. Or for example, the service tag **220** can indicate a turn-around time for the transaction.

[0027] It is also understood that the service tag **220** can include multiple packets. Similarly, an individual service tag **220** may comprise more than one indicator. These multiple packets, or indicators within a packet, may be combined to indicate the requested level of service. Separate packets (or indicators) may be included, such as, a time-stamp, an origination ID, an application ID, a user ID, a project ID, etc. In such an embodiment, the requested service level can be a combination of some or all of the packets included therein. For example, a transaction **200** can be handled with high priority where the user ID is "administrator" and the origination ID is "network administration tools". Or for example, a transaction **200** may be handled with high priority where the user ID is "user 1" and the time-stamp indicates the transaction must be completed during business hours. Likewise, a transaction **200** also having a user ID of "user 1" may be handled with lower priority where the time-stamp indicates that the transaction can be completed during off-peak hours.

[0028] Alternatively, these multiple packets can individually indicate or identify the requested level of service. For example, the service tag **220** may indicate a preferred level of service and a backup level of service. In such an embodiment, where the preferred level of service is unavailable, the transaction is preferably handled or processed according to the backup level of service. In addition, in this embodiment the transaction **200** may be "bounced" (i.e., returned to the originating computer) where neither the preferred level of service nor the backup level of service can be provided. Or a warning or a message may be returned to the originator where either the backup level of service is provided or where neither is provided.

[0029] In yet another alternative, the transaction **200** can be prioritized based on a first packet (or indicator) or set of packets (or indicators), and the remaining packets (or indicators) are read or factored in only where there is a conflict between service levels requested by more than one transaction **200**. For example, where the user ID packet is "administrator" for more than one transaction **200**, the competing transactions **200** can be hierarchically prioritized based on the application ID packet, and so forth.

[0030] It is also understood that the requested level of service need not be a separate packet (i.e., service tag **220**) associated with data packet **200**. For example, the requested level of service can be included as part of the destination packet **230**. Or for example, the requested level of service may be included with the data packet **210**.

[0031] Preferably, the transaction **200** is assigned a service tag **220** at its source (i.e., where the transaction **200** originates). However, it is understood that the service tag **220** may be assigned and/or changed at any suitable device along the transaction path, as explained below with respect to **FIG. 9**.

[0032] It is understood that the requested level of service indicated by the service tag **220** may be assigned to the transaction **200** based on any number of factors. The requested level of service may be based on the time sensitivity of the transaction **200**. For example, data that is time sensitive may be assigned a higher priority than data that is not time sensitive. Or for example, a transaction **200** that would normally be assigned to a slow server during business hours can be assigned to a faster server during evening hours and on weekends. The requested level of service may also be based on characteristics or parameters of the transaction **200** itself. For example, large processing requests can be assigned to faster servers. The requested level of service may also be based on the user identification. For example, users that generally require faster processing speeds (the CAD department or an administrator) may be assigned faster servers than those who require the servers only to back up data. Likewise, users (e.g., an administrator) can be designated as having the highest priority, overriding competing transactions.

[0033] In addition, the requested level of service may be manually assigned to a transaction **200**. That is, the requested level of service may be user-defined. Suitable program code (e.g., a user interface) can be included at a network device (e.g., a workstation, router, etc.) or as part of an application (e.g., an operating system, the originating application, an applet, etc.). For example, the user may be queried before starting an application as to the requested level of service. The user might have predefined options (e.g., a menu, list, etc.). Or the user may specify a requested level of service (e.g., using predefined commands or command strings). Alternatively, the requested level of service may be set by an administrator. For example, the administrator may assign a priority to a particular workgroup, user, project, application, etc.

[0034] In another embodiment, the requested level of service may be automatically assigned to a transaction **200**. That is, the requested level of service may be assigned by a network device (e.g., a workstation, router, etc.) or an application (e.g., an operating system, the originating application, an applet, etc.). Suitable program code can be included at the network device and/or the application to assign the requested level of service based on a fixed parameter(e.g., a user ID, application ID, passcode, etc.), a dynamic parameter (e.g., the time of day, current load, etc.) or a combination thereof.

[0035] In yet another embodiment, the requested level of service may be selected through a combination of manual and automatic identification. For example, the user may define a requested level of service, and the transaction may be automatically marked with an application ID, a time-stamp, etc. In such an embodiment, the transaction **200** may be handled based on the user-defined level of service, the automated markings, or a combination thereof.

[0036] It is understood that the above examples are merely illustrative of the requested level of service and associating it with the data packet **210** (e.g., assigned to the transaction **200**). Other examples are also contemplated as within the scope of the present invention.

[0037] **FIG. 3** shows the transaction **200** received at a load balancer **300** and directed to a server **311, 312, 313** in a server pool **310** that is best able to process the transaction **200** based on the requested level of service indicated by the service tag **220**. In **FIG. 3**, the load balancer **300** selected

server **312** (Server B) as the server that is best able to process the transaction **200**, using the service tag **220** and the server index **400** (**FIG. 4**).

[0038] The server index **400** (**FIG. 4**) is preferably a multi-dimensional array (e.g., a database or "lookup table") stored in a memory accessible by the load balancer **300**. The server index **400** includes at least a server identification (ID) **410** and a corresponding service level **420** for each server **311, 312, 313** in the server pool **320** that is managed by the load balancer **300**. The server ID **410** can be the server IP address, a path, or any other suitable means that the load balancer **300** can use to identify a server **311, 312, 313** and direct a transaction **200** thereto. Other data related to the various servers can also be included in the server index, such as that status of a particular server (e.g., availability, current load), alternative or backup servers or server pools, etc.

[0039] The service level **420** can be any suitable indicator, such as but not limited to a number on a scale of one to ten, a category of service, the time (e.g., weekday or weekend), a user identification (e.g., user1, user2, administrator), a transaction type (e.g., email, video), a combination thereof, etc. Furthermore, the service level can be based on information about the monitored servers obtained by polling the servers, predefined service specifications, etc. Likewise, the servers can be ranked relative to one another, relative to the types of transactions processed, etc.

[0040] When the transaction **200** is received by the load balancer **300**, the service tag **220** is read using suitable program code. The load balancer **300** then accesses the server index **400** to determine (e.g., using suitable program code) the server in the server pool **310** that can best provide the requested level of service associated with the transaction **200** (i.e., as indicated by the service tag **220**). For example, where the service tag **220** indicates a requested level of service having a scale value of "50", the server index **400** indicates that server **312** (Server B) is providing a corresponding service level **420** having a scaled value of "51", while the other servers **311** and **313** are providing lower levels of service. Hence, the load balancer **300** directs the transaction to server **311** (Server B), as shown in **FIG. 3**. As another example, where the service tag **220** indicates the requested level of service is a scaled value of "25", the load balancer **300** directs the transaction **200** to server **313** (Server C), which is providing a corresponding service level **420** having a scaled value of "27", as indicated by the server index **400**.

[0041] It is to be understood that the term "best", as that term is used herein with respect to the server best able to provide the requested level of service, is defined to mean "best as determined by the program code of the load balancer", and may be interpreted by a load balancer as, for example, "nearest" or "meeting" the requested level of service. Thus, even where the requested level of service and the service level actually being provided are at opposite ends of a spectrum (e.g., the requested level of service is a scaled value of "50" but the service levels being provided by the servers range from scaled values of "5" to "10"), the server providing the service level nearest to that requested (e.g., a service level having a scaled value of "10") is considered to be "best" able to provide the requested level of service. However, it is also to be understood that where the disparity between the requested level of service and the service level being provided is unacceptable (i.e., based on a predetermined level of acceptability, such as more than "10" scale values difference), the load balancer **300** can direct the transaction to the server best able to provide the requested service level, but also return a warning signal (e.g., an email, an error message, etc.) to the requester (e.g., an administrator, the user, the originating application, etc.) notifying the requestor of the disparity. Alternatively, the load balancer **300** can redirect the transaction **200** to another load balancer that is monitoring another pool of servers, the load balancer **300** can "bounce" the transaction **200** altogether, etc.

[0042] It is also to be understood that the term "server" as used herein can be any computer or device that manages resources, such as a file server, a printer server, a network server, a database server, etc. In addition, the servers can be dedicated or the servers can be partitioned (i.e., have multiprocessing capability), in which case the term "server" may instead refer to software that is managing resources rather than to an entire computer or other hardware device.

[0043] In **FIG. 5**, the server pool **500** includes a premium group **510**, a standard group **520**, and a low priority group **530**. The servers **511, 512**, and **513** (A, B, and C, respectively) are part of the "premium" group **510**. For example, the premium group **510** can include high-speed, high-capacity servers. In addition, the premium group **510** can include additional servers and backup servers so that there is always an available server in this group. Access to these servers can be reserved for a department with high demand requirements (e.g., the CAD department), for high priority transactions, for customers paying a fee to access these servers, etc. The standard group **520** can include average-speed, average capacity servers. Access to these servers **521, 522** (D and E) can be designated for a sales/marketing department that requires only average processing capacity, or can also be available on a fee-basis. The "low priority" group **530** can include older and/or less expensive servers **531** that do not perform at the predetermined standards of the standard group **520** or the premium group **510**. These servers **531** can be used for low-priority email, backup jobs, transactions requested during off-peak hours when timeliness is not as important, etc. These servers can be designated as a group **530**, or simply be unclassified servers in the server pool **500**.

[0044] It is to be understood that any number of groups can be designated. The manner in which groups are designated can include static parameters such as processing speed, capacity, server proximity, etc. However, preferably the groups **510, 520, 530** are dynamically designated based on monitored performance of the individual servers. For example, where a "premium" server (e.g., **511**) is not performing to a predetermined standard, it can be reclassified as a standard or low priority server (i.e., in group **530**), whereas a standard server (e.g., **521**) that has recently been upgraded can be reclassified as a premium server (i.e., in group **510**). Likewise, the invention disclosed herein is not to be limited by the groups **510, 520, 530** shown in **FIG. 5**. For example, more or fewer groups can be used, servers can be further subdivided within the groups, the groups can be identified by means other than the labels "premium", "standard", and "low", etc.

[0045] The service level being provided by each server can be based on, as illustrative but not limited to, the server meeting the service level objectives of a single user, a user

group (e.g., the accounting department), or a transaction type (e.g., email). That is, preferably the load balancer **300** (or suitable software/hardware agent) monitors the service level provided by each server in the server pool to generate the server index. For example, the load balancer **300** can measure or track processing parameters of a server (e.g., total processing time, processor speed for various transactions, etc.) with respect to a single user, a user group, a transaction type, etc. Alternatively, the server index can be based on known capabilities (e.g., processor speed, memory capacity, etc.) and/or predicted service levels of the servers in the server pool (e.g., based on past performance, server specifications, etc.). Or for example, the load balancer **300** can access multiple server indexes, wherein each index is based on a different set of monitored server parameters. A group ID or the like associated with a transaction can then be used as the basis for the load balancer **300** accessing a particular server index.

[0046] In any event, it is understood that the service level provided by each server in the server pool can be formatted similar to the requested level of service. Alternatively, program code for translation can be implemented (e.g., at the load balancer **300**) to convert between formats. For example, a category of service level, such as "premium", associated with the transaction **200** can be converted to a scale value, such as "50", associated with a server or group of servers in the server pool.

[0047] When the transaction **200** is received at the load balancer **300**, the load balancer **300** reads the requested level of service from the service tag **220**. Based on the server index **600** (**FIG. 6**), the load balancer **300** selects the server (e.g., **512**) from the server group (e.g., **510**) that is best providing the requested level of service (e.g., "premium"). That is, the server index **600** contains the server ID **610** and a corresponding level of service **620**, similar to the server index **400** in **FIG. 4**. However, in server index **600**, the server ID **610** is indicated as a group of servers. That is, Servers A, B, and C, are providing a "premium" level of service, Servers D and E are providing a "standard" level of service, and Server F is providing a low-priority level of service. Thus for example, where the service tag **220** indicates that the requested level of service is "premium", the load balancer **300** directs the transaction **200** to any one of the servers **511**, **512**, **513** in the premium group **510**. The load balancer can use conventional load balancing algorithms (e.g., next available, fastest available, or any other suitable algorithm) to select a specific server **511**, **512**, **513** within the premium group **510**.

[0048] It is understood that the load balancing schemes shown in **FIG. 3** and **FIG. 5** are illustrative of the apparatus and method of the present invention and are not intended to limit the scope of the invention. Other configurations are also contemplated as being within the scope of the invention. For example, multiple load balancers can be networked to administer a single server pool or multiple server pools. Such a configuration allows a load balancer experiencing heavy use to transfer some or all of the transactions in bulk to another load balancer experiencing a lighter load. Or for example, a hierarchy of load balancers might administer the server pool. A possible hierarchical configuration could comprise a gatekeeping load balancer that directs transactions either to a load balancer monitoring a premium server pool or to a load balancer monitoring a standard server pool, and the individual load balancers can then select a server from within the respective server pool.

[0049] **FIG. 7** shows a method for routing the transaction **200** to a server based on a requested level of service associated with the transaction **200** generated in step **710**, using suitable program code and stored on a number of (i.e., one or more) suitable computer readable storage media. In step **700**, the load balancer **300** (or a suitable software/hardware agent) monitors the server pool **320**, **500** to determine the service level of each server in the server pool. In step **710**, the load balancer **300** (or a suitable software agent) uses the monitored data to generate a server index (e.g., **400**, **600**) having at least the server ID (e.g., **410**, **610**) and the corresponding service level (e.g., **420**, **620**), including groups of servers where desired. In step **720**, when a transaction **200** is received at the load balancer **300**, the load balancer **300** (or suitable program code associated therewith) reads the requested level of service indicated by the service tag **220** associated with the transaction **200**. In step **730**, the load balancer **300** accesses the server index to select a server from the server pool that is best able to provide the requested level of service. Once a server has been selected, the load balancer **300** directs the transaction **200** to the selected server in the server pool in step **740**.

[0050] It is understood that the method shown and described with respect to **FIG. 7** is merely illustrative of a preferred embodiment. However, each step need not be performed under the teachings of the present invention. Step **710** can be modified or eliminated, as an example, where a server index is provided with a predetermined server ID and the corresponding service level is packaged with the load balancer **300**. Likewise, the steps need not be performed in the order shown in **FIG. 7**. For example, the transaction **200** can be received and the service tag **220** read by the load balancer (as in step **720**), followed by the load balancer **300** monitoring the server pool for a server providing the requested level of service (as in step **700**). In such an example, it is also understood that a server index need not be generated at all (as in step **710**) and that the load balancer can select a server dynamically (i.e., based on current server performance).

[0051] **FIG. 8** shows a method for identifying a requested level of service for a transaction, wherein the transaction may be processed in accordance with the requested level of service. In step **800**, the requested level of service is selected for the transaction **200**. The requested level of service can be selected by the original application, an administrator, etc., as explained above. Likewise, the requested level of service can be based on any suitable factors and assigned by any suitable device on the network. In step **810**, the requested level of service is assigned to the transaction **200** (e.g., as a service tag **220** associated with the data packet **210**). In step **820**, the service tag **220** is read (e.g., by a load balancer **300** in **FIG. 3** and **FIG. 5**) using suitable program code. In step **830**, the transaction **200** is directed to and processed by a network device, such as a server in server pool **310**, **500** (**FIG. 3** and **FIG. 5**, respectively) based on the service tag **220**, as discussed above.

[0052] **FIG. 9** illustrates various points of a system where the service tag **220** may be assigned to the transaction **200**. For example, the service tag **220** may be assigned to the transaction **200** at the originating application **900** via a graphical user interface (GUI) **905** or via other suitable program code **910** integrated as part of the application or interacting therewith. Or for example, the service tag **220** may be assigned at a workstation **920** via the operating system (OS) **925** or other suitable program code executed on the workstation **920**. In another example, the service tag **220**

may be assigned on the local area network **930** by a network component **935** (e.g., a server, another workstation, a router, hub, etc.), and/or on the wide area network **940**, also by a network component **945**.

[0053] It is understood that the service tag **220** may be assigned to the transaction **200** at any number of points, and **FIG. 9** is merely intended to be an illustration thereof. Other examples include assigning the service tag **220** to the transaction **200** by an intermediary computer, a gateway, a load balancer, etc. Another example may include dynamically assigning the service tag **220**. That is, the service tag **220** may be assigned to the transaction **200** at the originating application **910**, then appended at the operating system **925**, and further changed at a router **935** and/or **945** on the network **930** and/or **940** before the transaction **200** reaches the destination. More specifically, the user may request a level of service of "high priority" for a transaction **200** via GUI **905**. The operating system **925** may subsequently append a backup level of service of "medium priority" to the transaction **200**. A router **935** and/or **945** that receives the transaction **200** while handling a heavy load from a high priority user (e.g., an administrator), may then change the requested level of service to "best available". As such, the service tag **220** need not be statically assigned.

[0054] While illustrative and presently preferred embodiments of the invention have been described in detail herein, it is to be understood that the inventive concepts may be otherwise variously embodied and employed, and that the appended claims are intended to be construed to include such variations, except as limited by the prior art.

What is claimed is:

1. An apparatus for identifying a requested level of service for a transaction, comprising:

computer readable storage media; and

computer readable program code stored in said storage media, comprising:

a) program code for selecting said requested level of service for said transaction; and

b) program code for assigning said requested level of service to said transaction.

2. An apparatus, as in claim 1, wherein said transaction is a packetized signal comprising at least a data packet, and wherein a service tag is associated with said data packet by said program code for assigning said requested level of service, said service tag including said requested level of service.

3. An apparatus, as in claim 1, further comprising:

a) program code for selecting a backup level of service; and

b) program code for assigning said backup level of service to said transaction.

4. An apparatus, as in claim 1, wherein said requested level of service is a predefined service category.

5. An apparatus, as in claim 1, wherein said requested level of service is based on a user identification.

6. An apparatus, as in claim 1, wherein said requested level of service is based on a transaction type.

7. An apparatus, as in claim 1, further comprising a user interface for selecting said requested level of service.

8. An apparatus, as in claim 1, wherein said requested level of service includes a plurality of parameters.

9. A method for requesting a level of service for a transaction on a network, comprising:

selecting said requested level of service for said transaction; and

assigning said requested level of service to said transaction.

10. A method, as in claim 9, wherein selecting said requested level of service comprises receiving a user-defined level of service.

11. A method, as in claim 9, wherein selecting said requested level of service comprises assessing a number of characteristics of said transaction.

12. A method, as in claim 9, wherein a network device best provides said requested level of service.

13. A method, as in claim 9, wherein said requested level of service is automatically assigned to said transaction.

14. An apparatus for routing a transaction over a network based on a requested level of service associated with said transaction, comprising:

a number of computer readable storage media; and

computer readable program code stored in said number of storage media, comprising:

a) program code for selecting said requested level of service for said transaction;

b) program code for assigning a service tag to said transaction, said service tag including said requested level of service;

c) program code for reading said requested level of service from said service tag; and

d) program code for directing said transaction over said network based on said requested level of service read from said service tag.

15. An apparatus, as in claim 14, wherein said transaction is directed over said network to a device best providing said requested level of service.

16. An apparatus, as in claim 14, wherein said service tag is assigned by program code at more than one point on said network.

17. An apparatus, as in claim 14, wherein said service tag is read by program code at more than one point on said network.

18. An apparatus, as in claim 14, further comprising program code for changing said requested level of service included on said service tag.

19. An apparatus for requesting a level of service for a transaction on a network, comprising:

means for selecting said requested level of service; and

means for assigning said requested level of service to said transaction, wherein said transaction is directed to a network device based on said requested level of service.

20. An apparatus, as in claim 19, further comprising means for reading said requested level of service assigned to said transaction.

* * * * *

US006052715A

United States Patent [19]

Fukui et al.

[11] Patent Number: 6,052,715

[45] Date of Patent: Apr. 18, 2000

[54] INTERACTIVE COMMUNICATION SYSTEM FOR DOWNLOADING LARGE AMOUNT DATA

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[73] Assignee: Casio Computer Co., Ltd., Tokyo, Japan

[21] Appl. No.: 08/855,455

[22] Filed: May 13, 1997

[30] Foreign Application Priority Data

May 16, 1996 [JP] Japan 8-122057

[51] Int. Cl.[7] H04H 1/00; H04N 7/173

[52] U.S. Cl. 709/217; 348/12

[58] Field of Search 348/6, 7, 10, 12, 348/13; 455/3.1, 3.2, 4.1, 4.2, 6.1, 6.2, 5.1; 709/217–219

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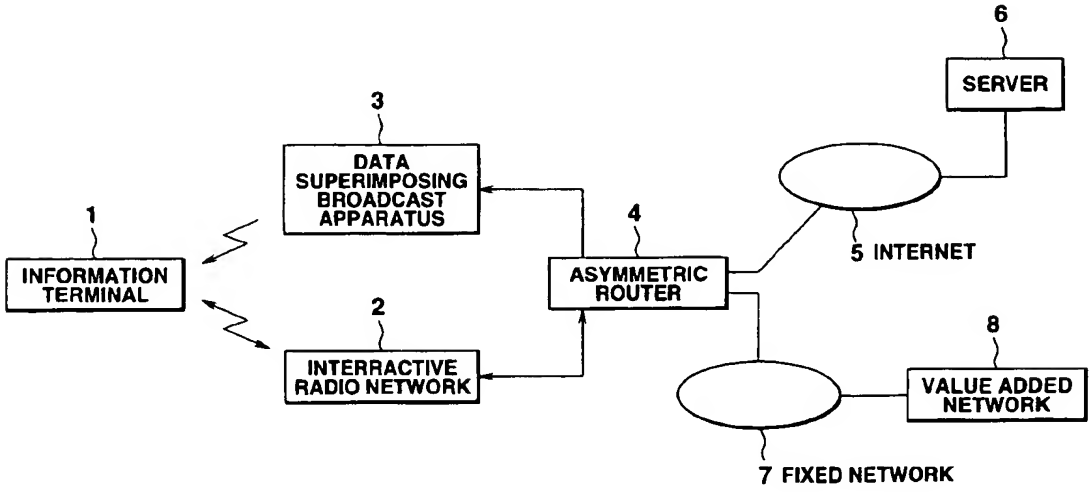
Primary Examiner—Nathan Flynn

Attorney, Agent, or Firm—Frishauf, Holtz, Goodman, Langer & Chick, P.C.

[57] ABSTRACT

An information terminal transmits small amount data such as a command to a Web server on the internet to an asymmetric router via an interactive radio network. The asymmetric router transmits the command to the Web server via the internet. The asymmetric router transmits large amount data (for example, HTML formatted browser data) from the Web server to a data superimposing broadcast apparatus. The data superimposing broadcast apparatus determines a scheduled time of broadcasting according to a data amount. The scheduled time is transmitted to the information terminal via the asymmetric router and the interactive radio network. When the scheduled time comes, the large amount data is superimposed on an empty portion of a television signal, and is broadcasted. The information terminal carries out a predetermined processing operation whereby a broadcast receiving circuit is turned on, and the television signal on which the large amount data has been superimposed is received. The received data then can be displayed in a display device and the like. Therefore, even in a portable information terminal, it is possible to provide an interactive communication system which can transmit large amount data at a high speed.

13 Claims, 14 Drawing Sheets



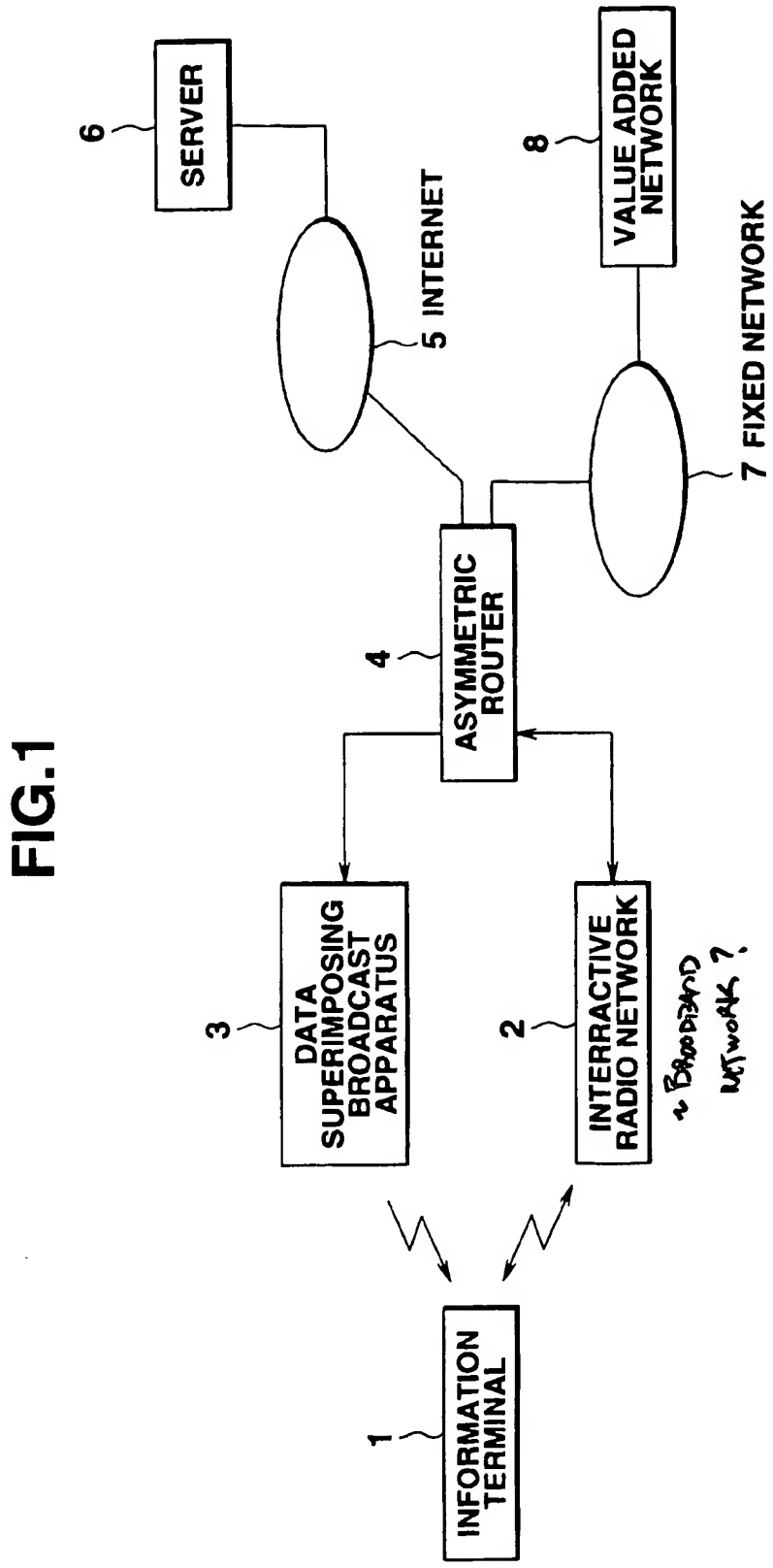

SERVER
6
VALUE ADDED NETWORK
8
5 INTERNET
7 FIXED NETWORK
ASYMMETRIC ROUTER
4
DATA SUPERIMPOSING BROADCAST APPARATUS
3
INTERRACTIVE RADIO NETWORK
2
INFORMATION TERMINAL
1

FIG.1

FIG.2

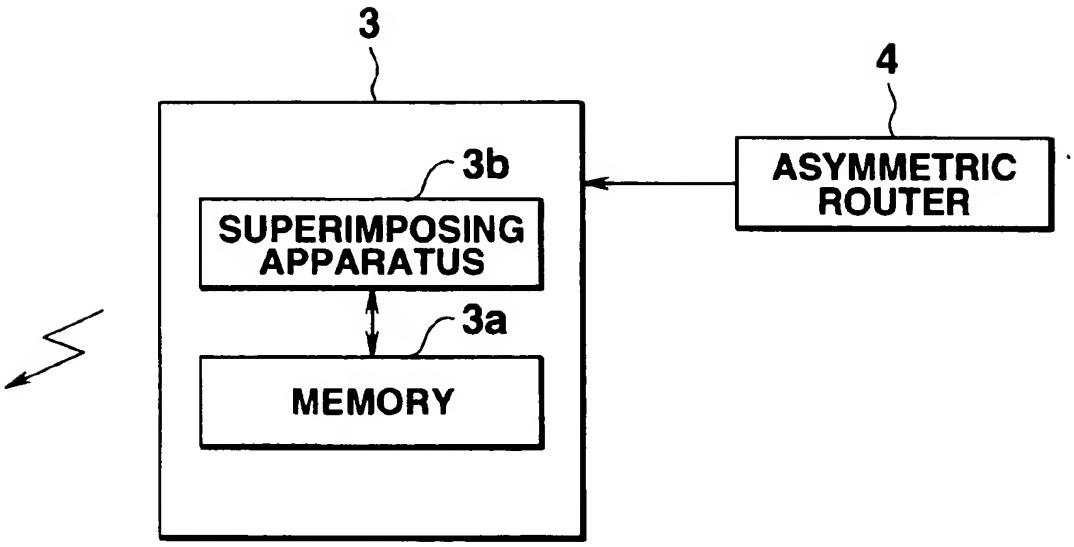

3
4
3b
SUPERIMPOSING APPARATUS
3a
MEMORY
ASYMMETRIC ROUTER

FIG.3

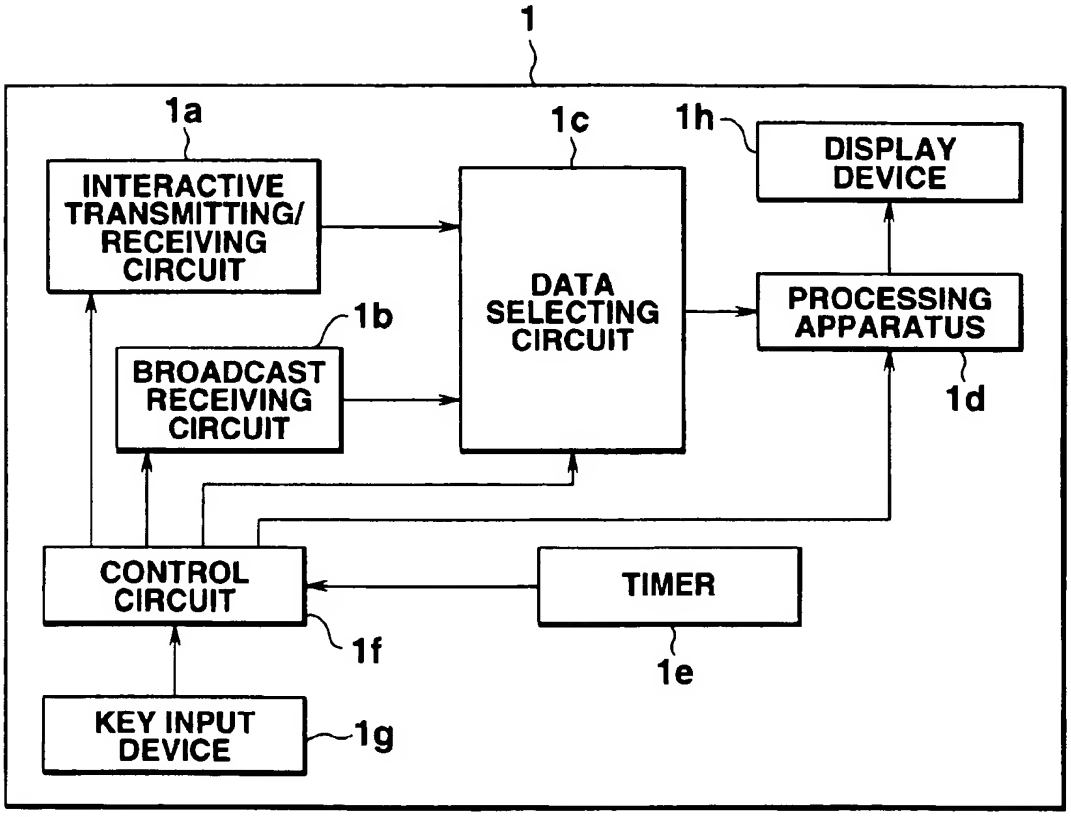

1
1a
1c
1h
DISPLAY DEVICE
INTERACTIVE TRANSMITTING/ RECEIVING CIRCUIT
DATA SELECTING CIRCUIT
PROCESSING APPARATUS
1b
BROADCAST RECEIVING CIRCUIT
1d
CONTROL CIRCUIT
TIMER
1f
1e
KEY INPUT DEVICE
1g

FIG.4

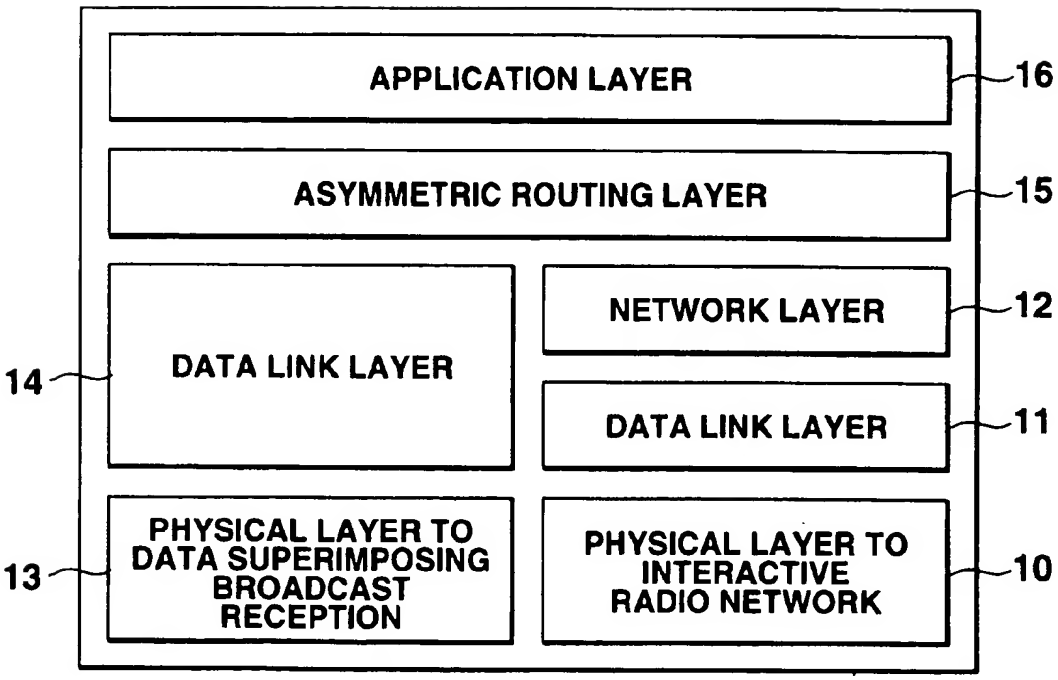

APPLICATION LAYER
16
ASYMMETRIC ROUTING LAYER
15
NETWORK LAYER
12
14
DATA LINK LAYER
DATA LINK LAYER
11
PHYSICAL LAYER TO DATA SUPERIMPOSING BROADCAST RECEPTION
13
PHYSICAL LAYER TO INTERACTIVE RADIO NETWORK
10

FIG.5

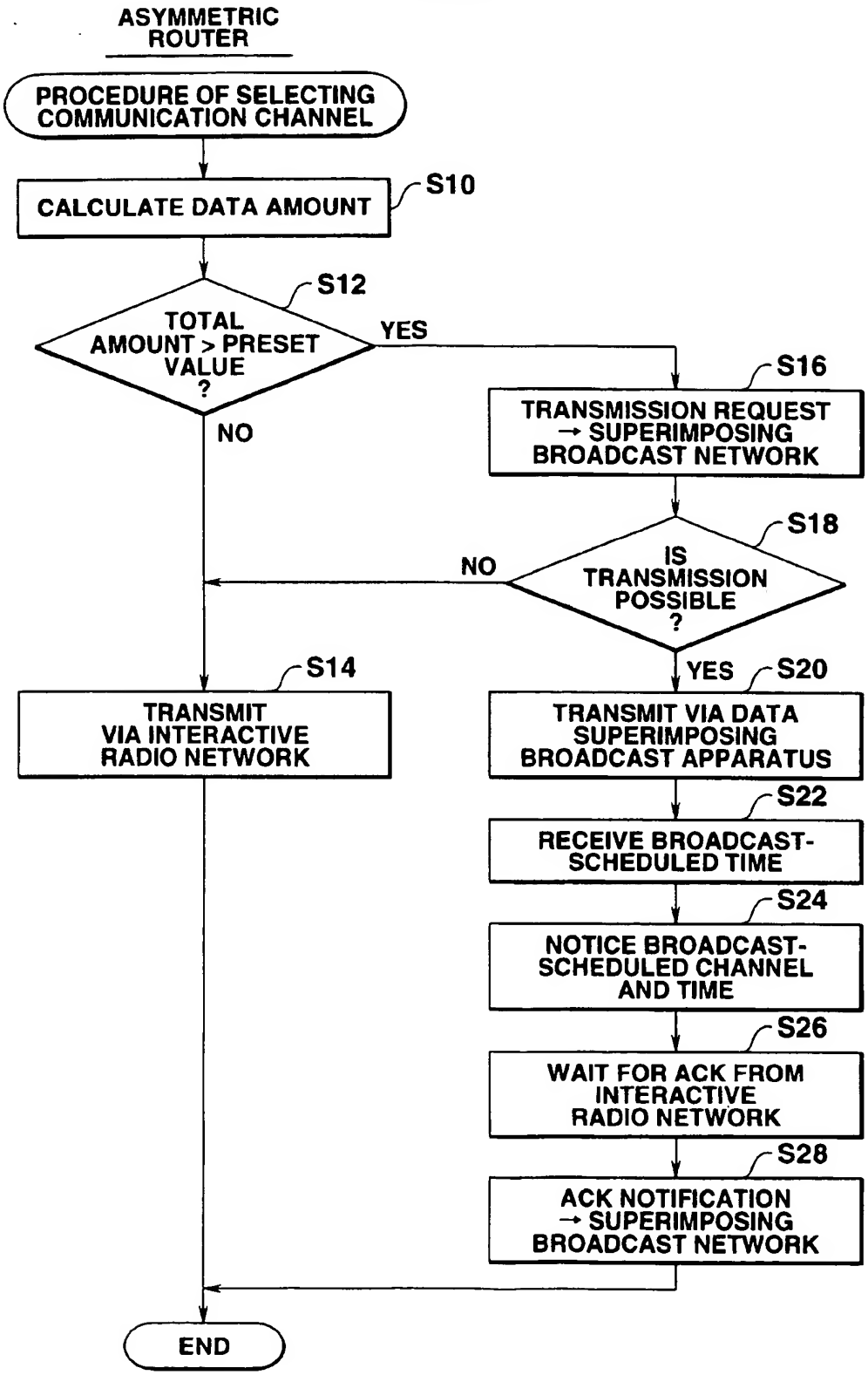

ASYMMETRIC ROUTER
PROCEDURE OF SELECTING COMMUNICATION CHANNEL
CALCULATE DATA AMOUNT
S10
S12
TOTAL AMOUNT > PRESET VALUE ?
YES
NO
S16
TRANSMISSION REQUEST → SUPERIMPOSING BROADCAST NETWORK
S18
IS TRANSMISSION POSSIBLE ?
NO
YES
S14
TRANSMIT VIA INTERACTIVE RADIO NETWORK
S20
TRANSMIT VIA DATA SUPERIMPOSING BROADCAST APPARATUS
S22
RECEIVE BROADCAST-SCHEDULED TIME
S24
NOTICE BROADCAST-SCHEDULED CHANNEL AND TIME
S26
WAIT FOR ACK FROM INTERACTIVE RADIO NETWORK
S28
ACK NOTIFICATION → SUPERIMPOSING BROADCAST NETWORK
END

FIG.6

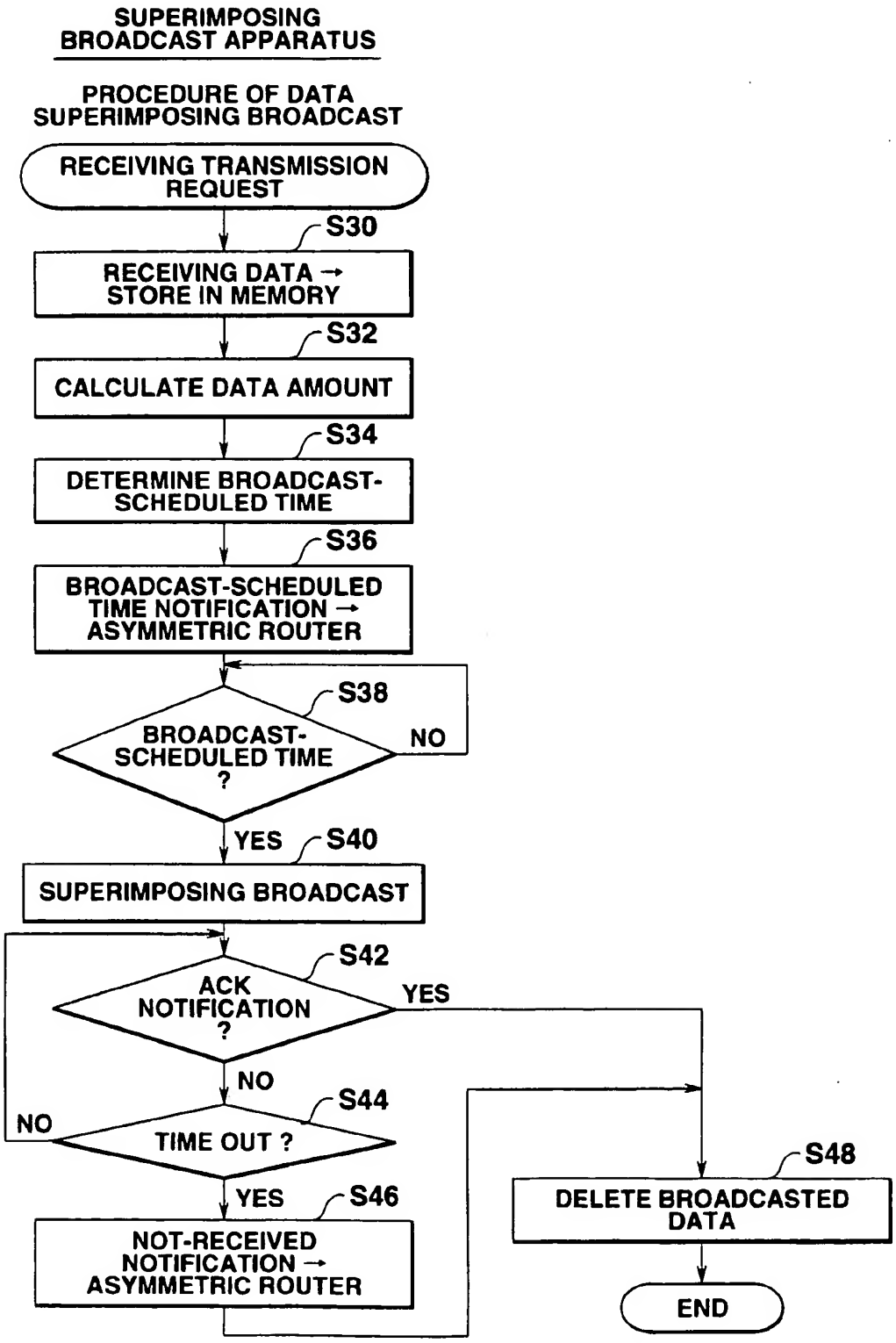

SUPERIMPOSING BROADCAST APPARATUS
PROCEDURE OF DATA SUPERIMPOSING BROADCAST
RECEIVING TRANSMISSION REQUEST
S30
RECEIVING DATA → STORE IN MEMORY
S32
CALCULATE DATA AMOUNT
S34
DETERMINE BROADCAST-SCHEDULED TIME
S36
BROADCAST-SCHEDULED TIME NOTIFICATION → ASYMMETRIC ROUTER
S38
BROADCAST-SCHEDULED TIME ?
NO
YES
S40
SUPERIMPOSING BROADCAST
S42
ACK NOTIFICATION ?
YES
NO
S44
TIME OUT ?
NO
YES
S46
NOT-RECEIVED NOTIFICATION → ASYMMETRIC ROUTER
S48
DELETE BROADCASTED DATA
END

FIG.7

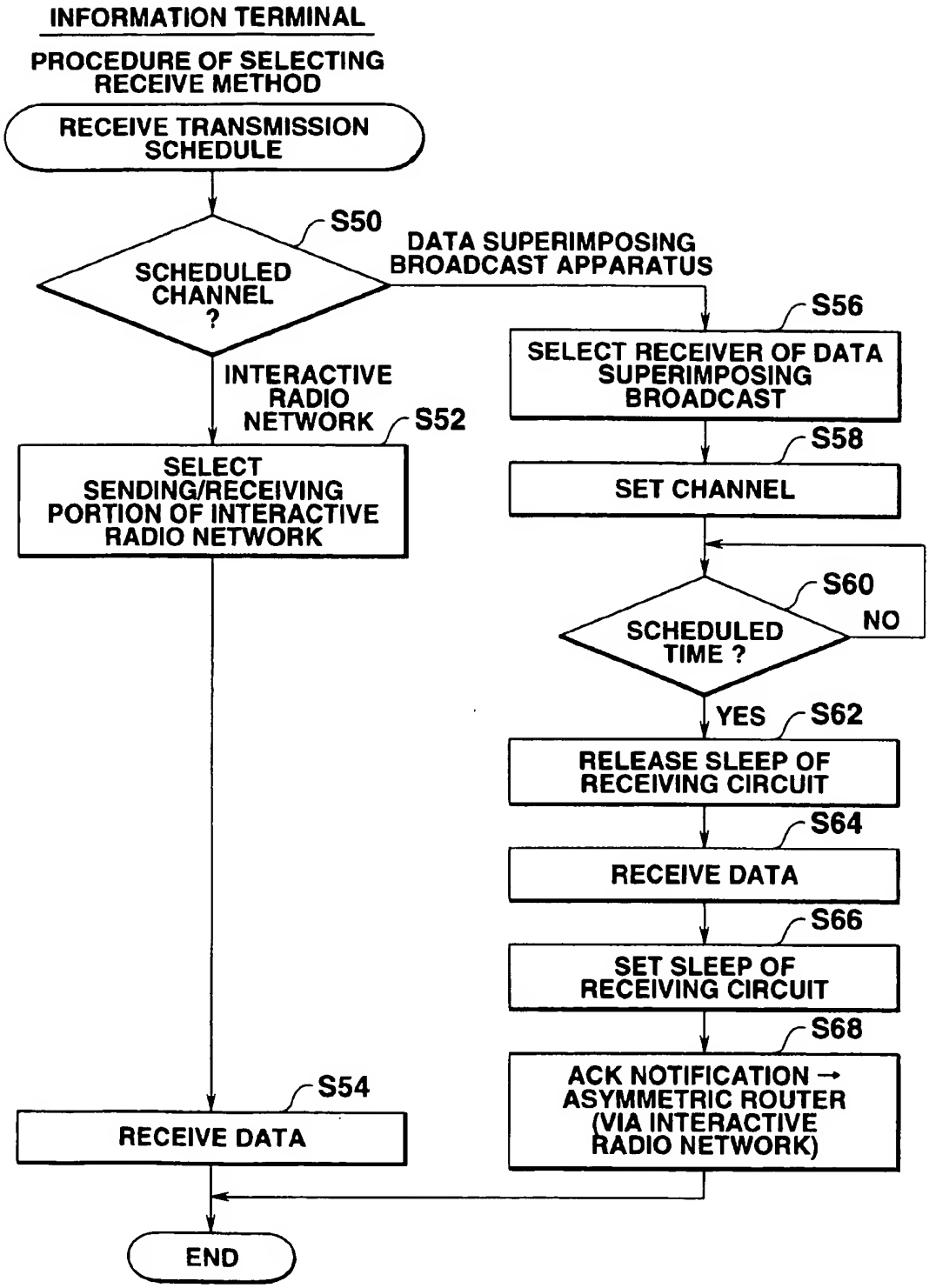

INFORMATION TERMINAL
PROCEDURE OF SELECTING RECEIVE METHOD
RECEIVE TRANSMISSION SCHEDULE
S50
SCHEDULED CHANNEL ?
DATA SUPERIMPOSING BROADCAST APPARATUS
INTERACTIVE RADIO NETWORK
S52
SELECT SENDING/RECEIVING PORTION OF INTERACTIVE RADIO NETWORK
S56
SELECT RECEIVER OF DATA SUPERIMPOSING BROADCAST
S58
SET CHANNEL
S60
SCHEDULED TIME ?
NO
YES
S62
RELEASE SLEEP OF RECEIVING CIRCUIT
S64
RECEIVE DATA
S66
SET SLEEP OF RECEIVING CIRCUIT
S68
ACK NOTIFICATION → ASYMMETRIC ROUTER (VIA INTERACTIVE RADIO NETWORK)
S54
RECEIVE DATA
END

FIG.8

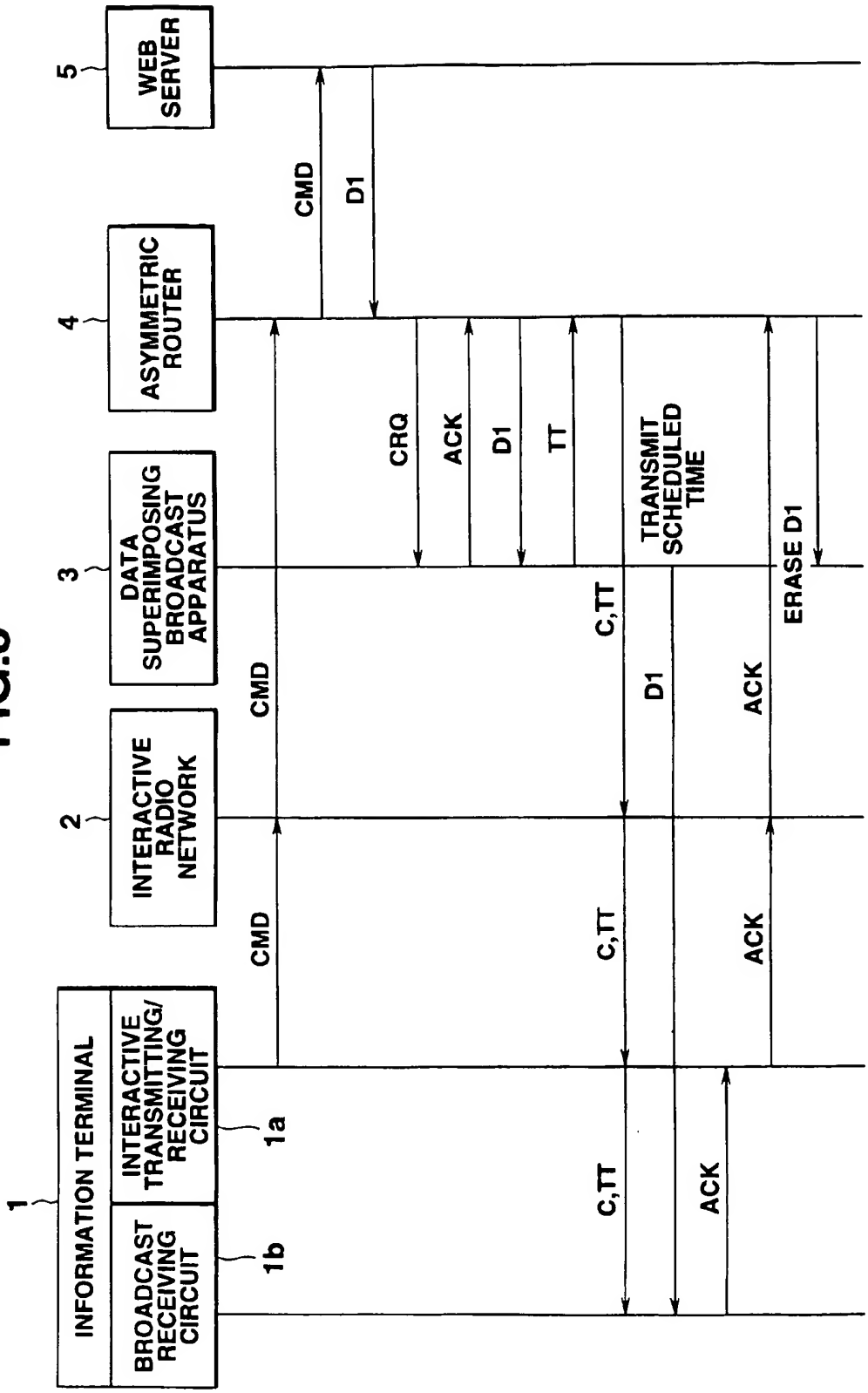

1
INFORMATION TERMINAL
BROADCAST RECEIVING CIRCUIT
1b
INTERACTIVE TRANSMITTING/ RECEIVING CIRCUIT
1a
2
INTERACTIVE RADIO NETWORK
3
DATA SUPERIMPOSING BROADCAST APPARATUS
4
ASYMMETRIC ROUTER
5
WEB SERVER
CMD
D1
CRQ
ACK
D1
TT
TRANSMIT SCHEDULED TIME
ERASE D1
CMD
C,TT
D1
ACK
CMD
C,TT
ACK
CMD
C,TT
ACK

FIG.9

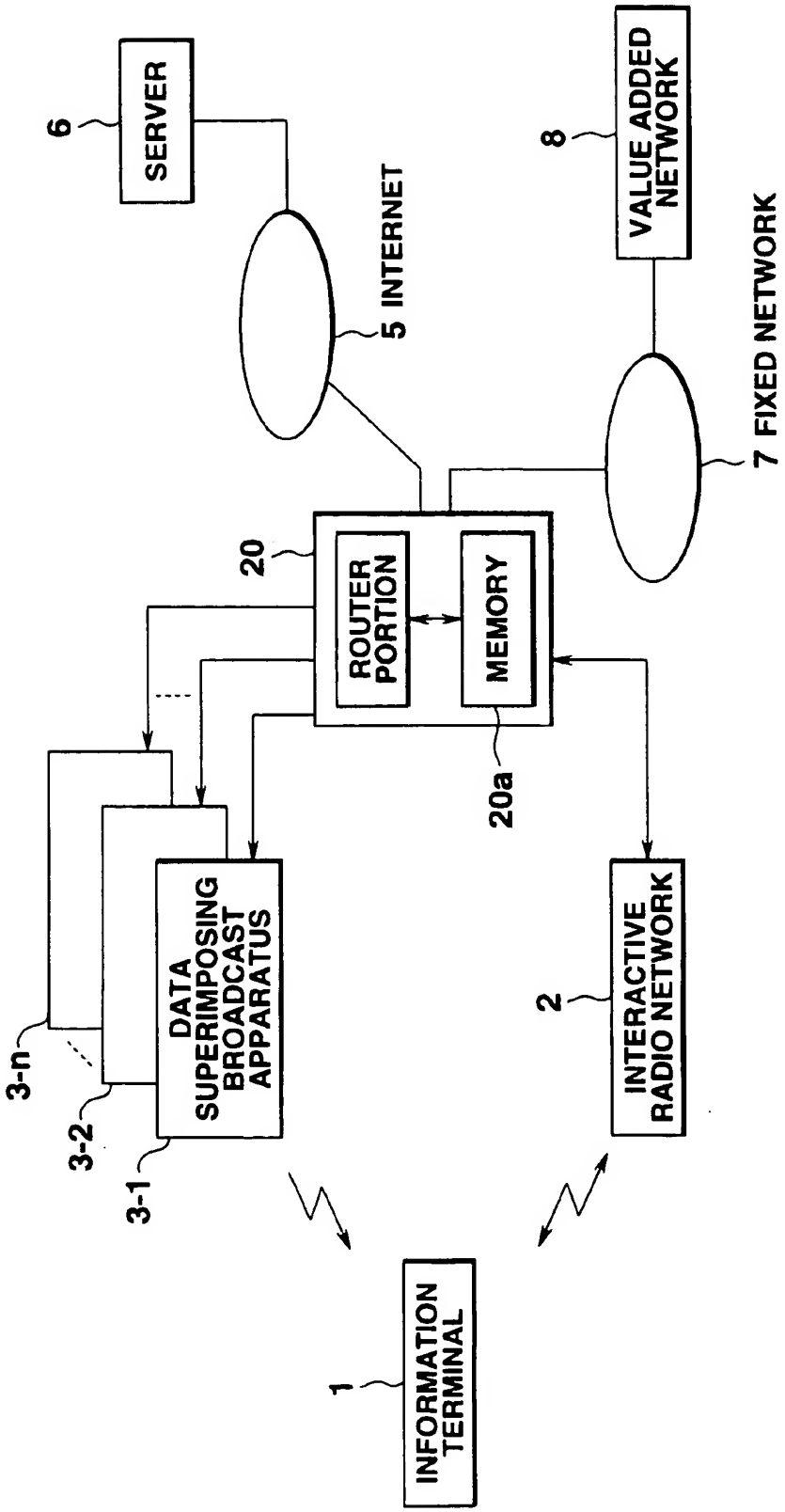

6
SERVER
5 INTERNET
8
VALUE ADDED NETWORK
7 FIXED NETWORK
20
ROUTER PORTION
MEMORY
20a
DATA SUPERIMPOSING BROADCAST APPARATUS
3-n
3-2
3-1
2
INTERACTIVE RADIO NETWORK
1
INFORMATION TERMINAL

FIG.10

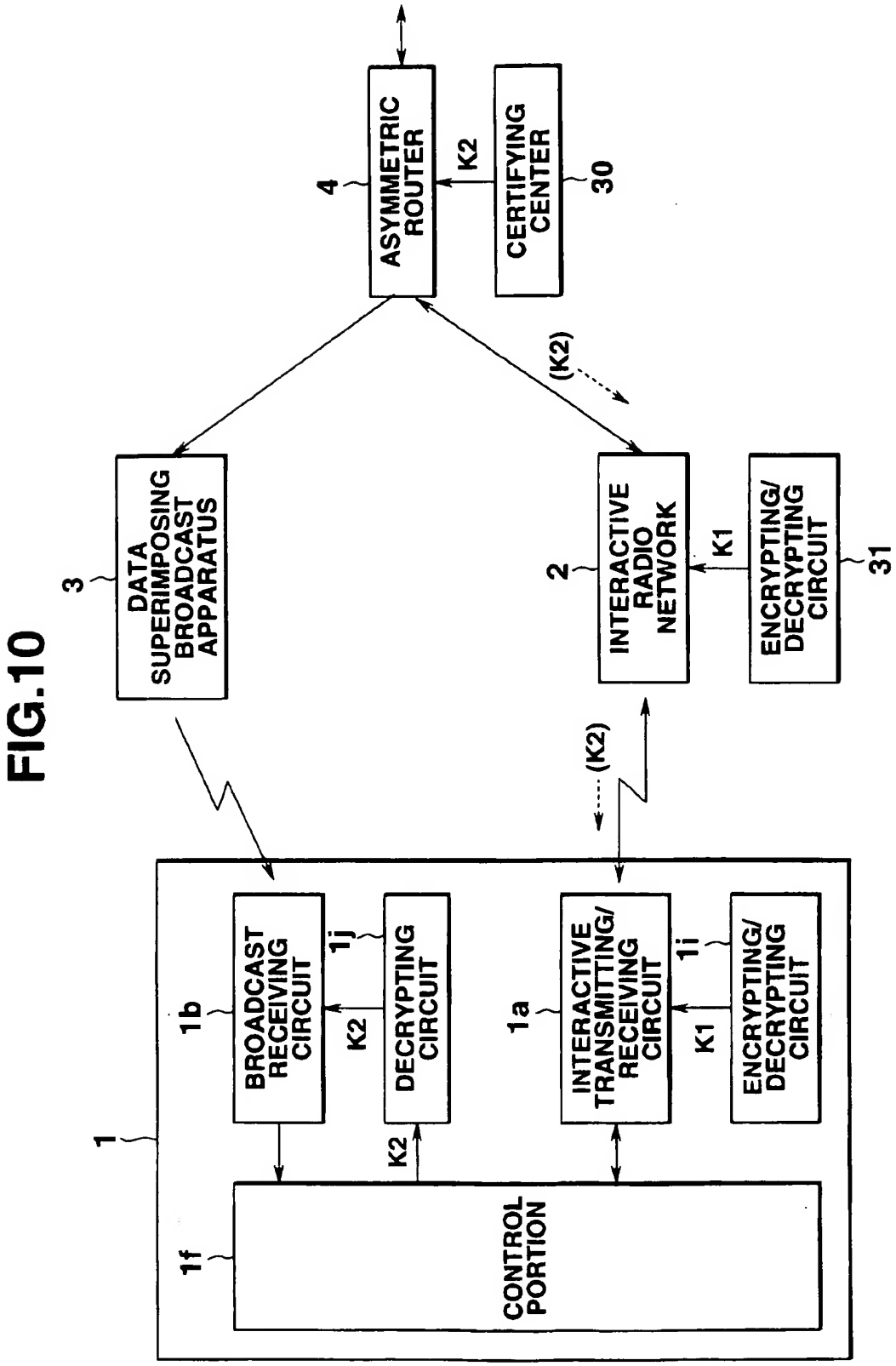

ASYMMETRIC ROUTER
4
K2
CERTIFYING CENTER
30
(K2)
DATA SUPERIMPOSING BROADCAST APPARATUS
3
INTERACTIVE RADIO NETWORK
2
K1
ENCRYPTING/ DECRYPTING CIRCUIT
31
(K2)
1
1b
BROADCAST RECEIVING CIRCUIT
1j
K2
DECRYPTING CIRCUIT
1a
INTERACTIVE TRANSMITTING/ RECEIVING CIRCUIT
1i
K1
ENCRYPTING/ DECRYPTING CIRCUIT
K2
1f
CONTROL PORTION

FIG.11

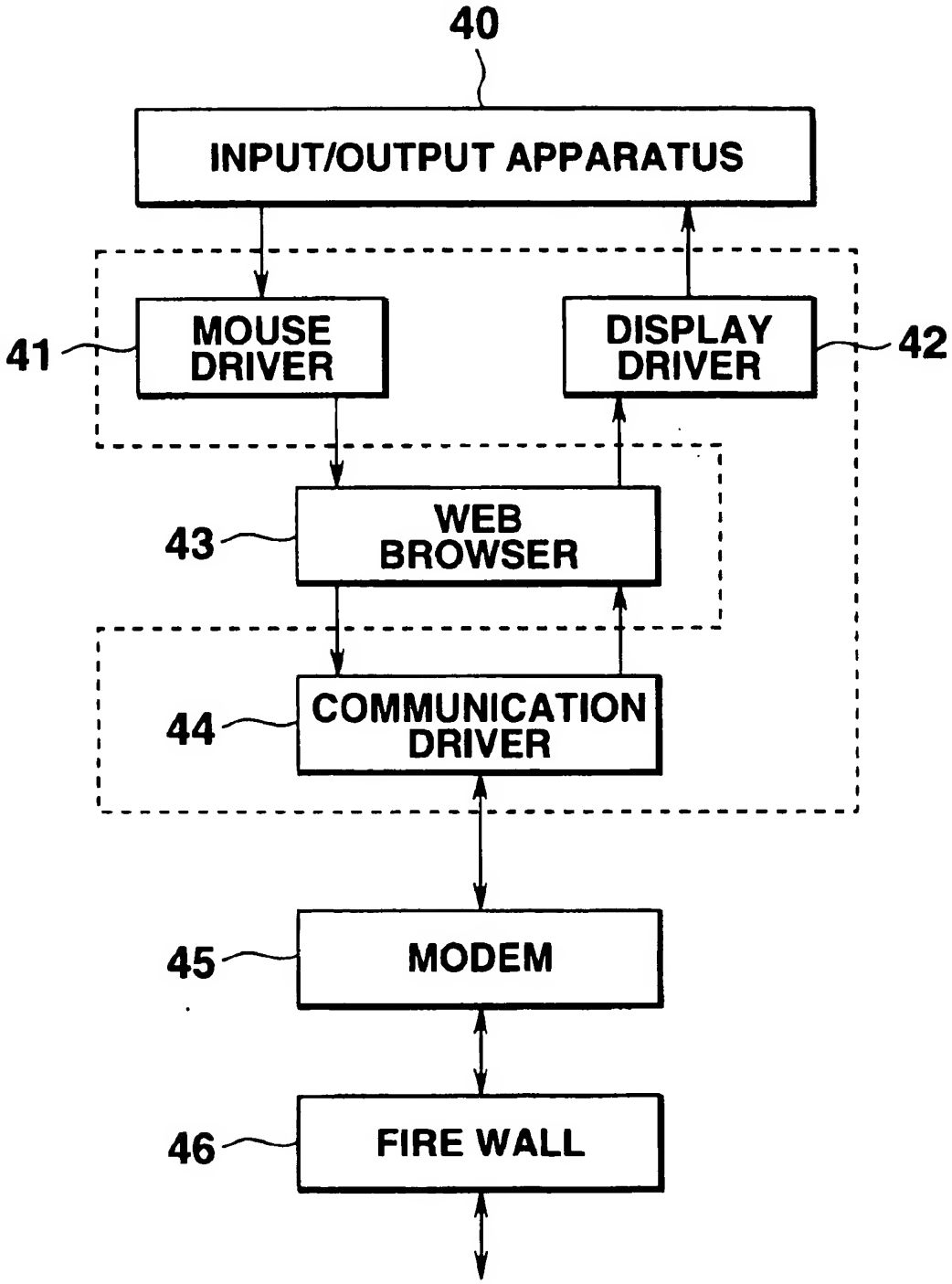

40
INPUT/OUTPUT APPARATUS
41
MOUSE DRIVER
DISPLAY DRIVER
42
43
WEB BROWSER
44
COMMUNICATION DRIVER
45
MODEM
46
FIRE WALL

FIG.12

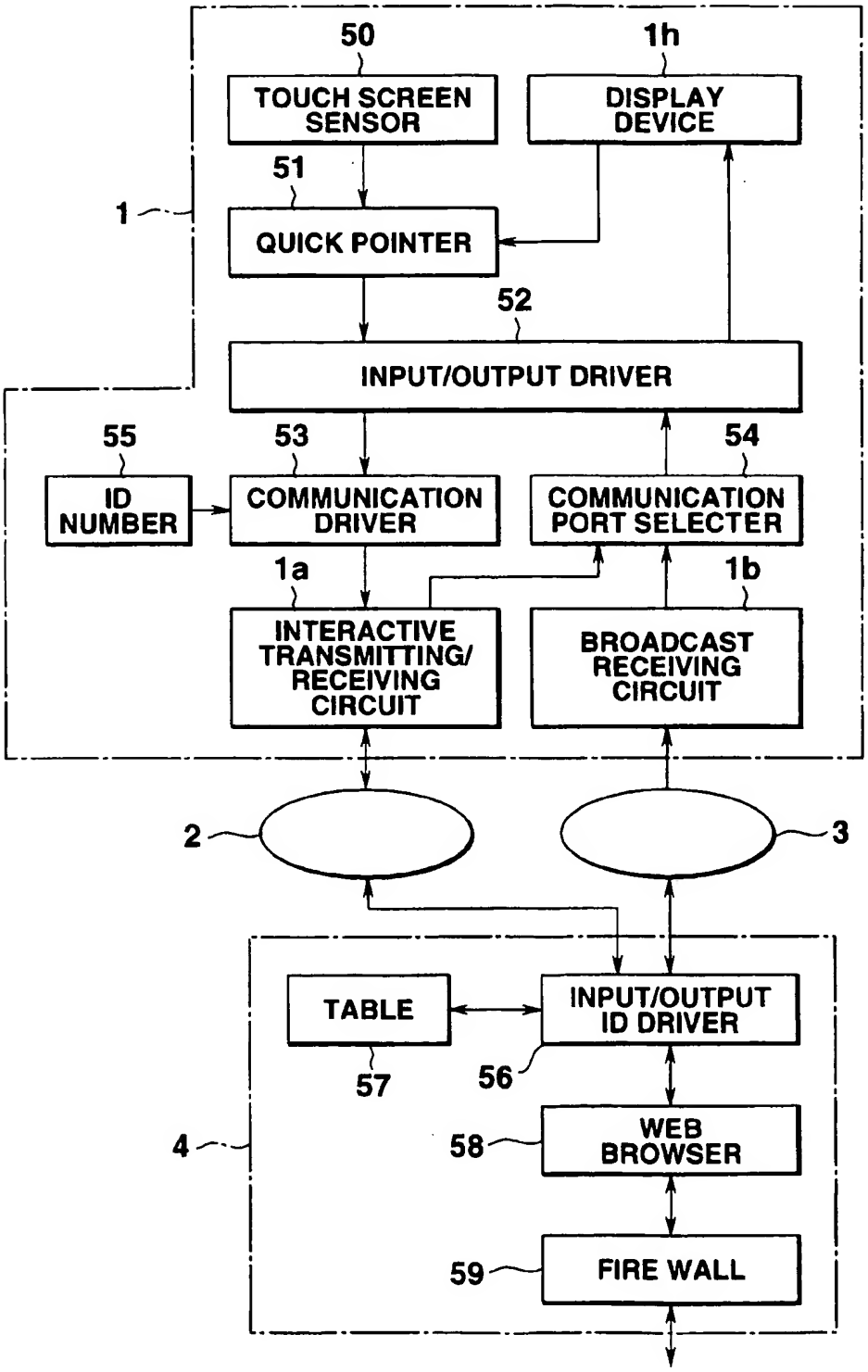

50
1h
TOUCH SCREEN SENSOR
DISPLAY DEVICE
51
1
QUICK POINTER
52
INPUT/OUTPUT DRIVER
55
53
54
ID NUMBER
COMMUNICATION DRIVER
COMMUNICATION PORT SELECTER
1a
1b
INTERACTIVE TRANSMITTING/ RECEIVING CIRCUIT
BROADCAST RECEIVING CIRCUIT
2
3
TABLE
INPUT/OUTPUT ID DRIVER
57
56
4
58
WEB BROWSER
59
FIRE WALL

FIG.13

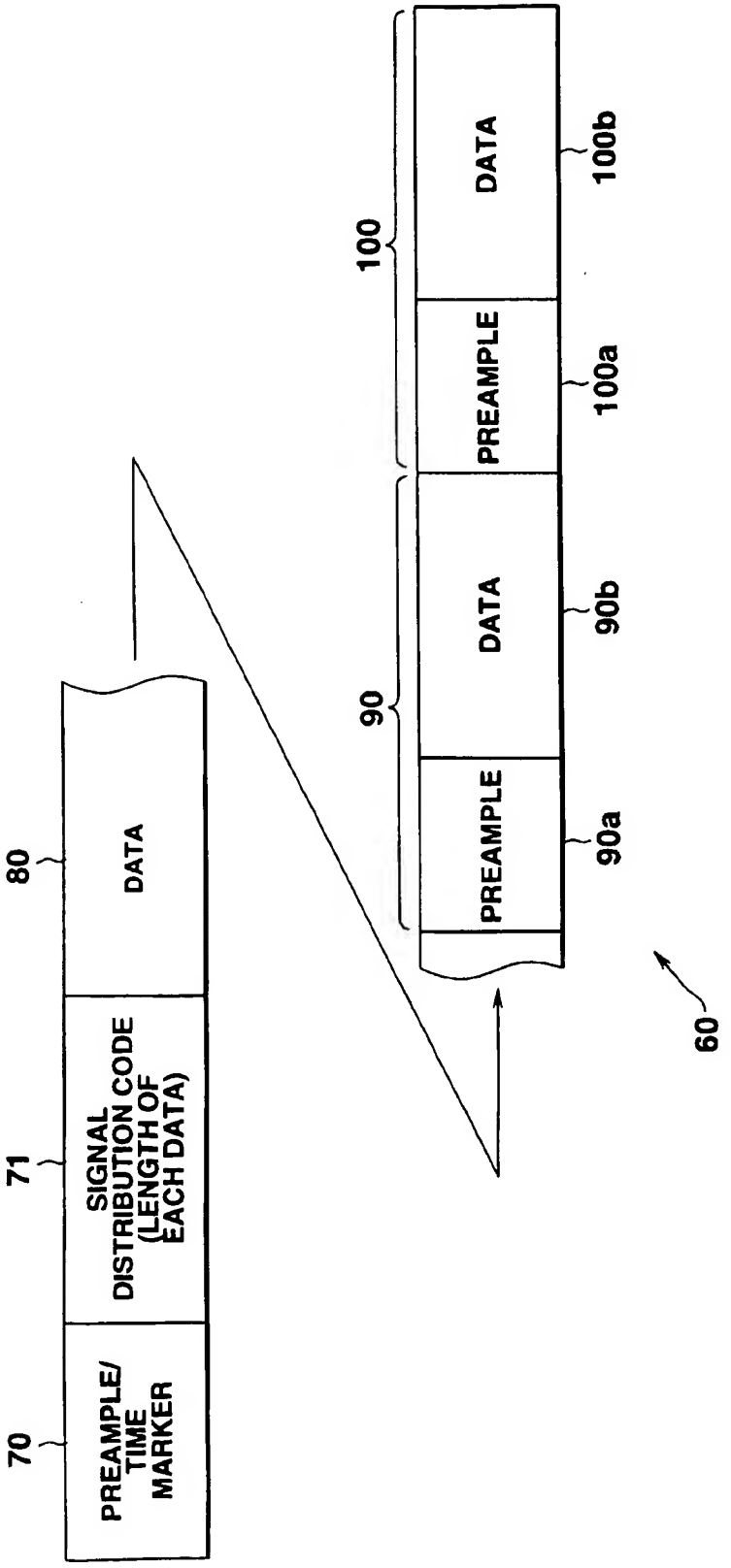
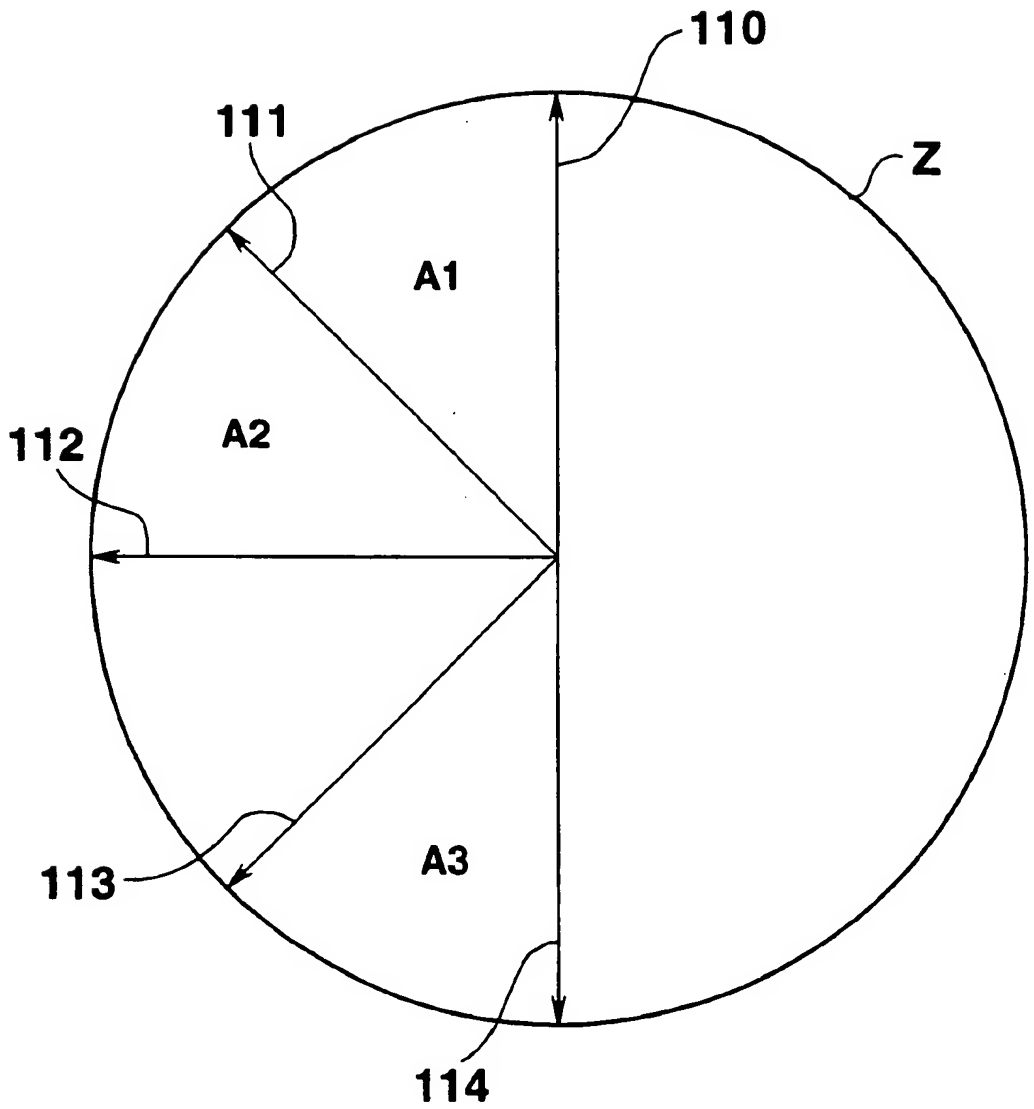

PREAMPLE/ TIME MARKER
70
SIGNAL DISTRIBUTION CODE (LENGTH OF EACH DATA)
71
DATA
80
PREAMPLE
90a
DATA
90b
90
PREAMPLE
100a
DATA
100b
100
60

FIG.14



INTERACTIVE COMMUNICATION SYSTEM FOR DOWNLOADING LARGE AMOUNT DATA

BACKGROUND OF THE INVENTION

The present invention relates to an interactive communication system which transmits/receives data at a high speed using an existing communication system.

This application is based on Japanese Patent Application No.08-122057, filed May 16, 1996, the contents of which are incorporated herein by reference.

Recently, the internet (which uses a general analog telephone line) or a digital private line has become widely known as an interactive communication system. Using the internet, HTML (i.e., Hypertext Markup Language) formatted data (a document comprising an image, a sound and a character or text) can be browsed, and a number of large amount data which are stored in servers distributed all over the world can be received.

For interactive communication, there exists a usual television broadcast system for unidirectionally transmitting images and sound to a user over a plurality of channels. In a television broadcast, an empty portion of a television signal is used so that a character information (character broadcast) is transmitted by a plurality of channels. The television broadcast thus provides a communication system which can transmit a large amount of information to the user.

Furthermore, as an interactive communication system for transmitting/receiving more information between a plurality of users, there is such an interactive communication system as VOD (Video On Demand) using a private communication line network in which an up link/down link is provided in a CATV (cable television) system so that the interactive communication can be carried out.

In the case of accessing the internet using a fixed terminal, for example, a computer and the like provided at home or in an office, data can be transmitted at a high speed. However, in the case of using a portable type information terminal (a mobile terminal) carried by the user, since the data is transmitted via a relay station (a base station of the interactive communication network), a maximum data transfer rate is about 9.6 kbps. For example, the portable information terminal is used so as to access a WWW (World Wide Web) server on the internet and to browse HTML formatted data (i.e., documents comprising image, sound and character data). In this case, when the data of 150 kbytes is received, it takes about 15 seconds, and there is a problem in that the data transfer rate is too slow and is not practical.

In Europe, in a ground wave digital broadcast which is put to practical use as a television broadcast, a mobile communication which can realize a transfer rate of about 1 Mbps forms a part of the service. In the case of using this communication system, in the above example, the data can be received in about 2 seconds. However, in the television broadcast and the ground digital broadcast, even if the data can be transmitted at the high speed, the user can only receive the data. Thus, there is such a problem in that interactive communication cannot be carried out.

Furthermore, in such an interactive communication system as CATV using a private line, service cannot be provided to the user at an optional place (i.e., such as in a train, a hall or a conference center). In other words, CATV can be provided to the user only at a specific place. Thus, there is a problem in that thus service cannot be provided for a mobile type information terminal.

BRIEF SUMMARY OF THE INVENTION

Therefore, it is an object of the present invention to provide an interactive communication system which can transmit large amount data at a high speed to an information terminal, and more specifically, to a portable information terminal.

According to a first aspect of the present invention, there is provided an interactive communication system comprising:

an interactive communication system in which data is transmitted/received between a host terminal and a terminal;

a large amount data transmitting system for unidirectionally transmitting a large amount data to the host terminal; and

a system switching apparatus for supplying data transmitted from the interactive communication system to the large amount data transmitting system so as to transmit the data to the host terminal via the large amount data transmitting system.

According to a second aspect of the present invention, there is provided an interactive communication system as recited in the first aspect in which the large amount data transmitting system comprises a broadcasting system for broadcasting a predetermined television signal, and when data is transmitted from the system switching apparatus, the data is superimposed to the television signal so that the data is broadcasted.

According to a third aspect of the present invention, there is provided an interactive communication system as recited in the first aspect in which the system switching apparatus, based on a data amount to be transmitted, selectively switches either the interactive communication system or the large amount data transmitting system for using as a data transmission channel.

According to a fourth aspect of the present invention, there is provided an interactive communication system as recited in the first aspect in which the large amount data transmitting system comprising:

storage means for temporarily storing transmitted data;

transmitting-scheduled time determining means for determining a scheduled time of broadcasting based on at least the data amount to be transmitted; and

transmitting means for transmitting the data stored in the storage means when the scheduled time of broadcasting determined by the transmitting-scheduled time determining means comes.

According to a fifth aspect of the present invention, there is provided an interactive communication system as recited in the fourth aspect in which the large amount data transmitting system supplies the scheduled time of broadcasting determined by the transmitting-scheduled time determining means to the host terminal via the interactive communication system; and

the host terminal receives the scheduled time of broadcasting supplied from the interactive communication system, and

when the scheduled time of broadcasting comes, the data from the large amount data transmitting system is received.

According to a sixth aspect of the present invention, there is provided an interactive communication system as recited in the first aspect in which the large amount data transmitting system comprises plural data transmitting devices which are located in each predetermined area; and

the system switching apparatus temporarily stores supplied data, stored data being transmitted to one of the data transmitting devices located in an area corresponding to a position information of the host terminal.

According to a seventh aspect of the present invention, there is provided an interactive communication system as recited in the first aspect in which the system switching apparatus performs a predetermined encryption using a predetermined encrypting key relative to data to be transmitted to the large amount data transmitting system; and

the host terminal decrypts encrypted large amount data transmitted from the large amount data transmitting system by using the predetermined encrypting key.

According to an eighth aspect of the present invention, there is provided an interactive communication system as recited in the seventh aspect in which the host terminal obtains the predetermined encryption key via the interactive communication system prior to a reception of the large amount data.

According to an ninth aspect of the present invention, there is provided an interactive communication system as recited in the first aspect in which the interactive communication system and the host terminal perform a predetermined encryption using a predetermined encrypting key relative to data to be transmitted/received, and encrypted data is decrypted by using the predetermined encrypting key.

According to a tenth aspect of the present invention, there is provided an interactive communication system as recited in the first aspect in which the host terminal comprises a plurality of server terminals for providing an HTML formatted file; and

the system switching apparatus browses the HTML formatted file provided by a predetermined server terminal on internet according to a command supplied from the server terminal via the interactive communication system, the HTML formatted file being converted into a display format data suitable for the server terminal so that the display format data is transmitted to the large amount data transmitting system.

According to an eleventh aspect of the present invention, there is provided an interactive communication system as recited in the sixth aspect in which the large amount data transmitting system transmits a communication information indicative of the interactive communication system which can be used in each area by the host terminal; and

the host terminal selects the interactive communication system to be used according to the communication information from the large amount data transmitting system.

According to a twelfth aspect of the present invention, there is provided an interactive communication system as recited in the first aspect in which the large amount data transmitting system transmits an identification code for specifying the host terminal by which the data is to be received for the data supplied from the system switching apparatus so as to transmit the data; and

the terminal determines whether or not the identification code provided for the data supplied from the large amount data transmitting system corresponds to the identification code which is preset to the identification code itself, the data being received only if a correspondence is detected.

According to a thirteenth aspect of the present invention, there is provided an interactive communication system as recited in the first aspect in which the host terminal supplies a position information indicative of a present position to the interactive communication system at a predetermined timing;

the system switching apparatus transmits the position information of the information terminal provided via the interactive communication system to the large amount data transmitting system; and

the large amount data transmitting system comprises a plurality of transmitting antennas having a different directivity, the data being transmitted from data transmission antenna having the corresponding directivity to the position information among the plurality of transmitting antennas.

Additional objects and advantages of the present invention will be set forth in the description which follows, and in part will be obvious from the description, or may be learned by practice of the present invention.

The objects and advantages of the present invention may be realized and obtained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate presently preferred embodiments of the present invention and, together with the general description given above and the detailed description of the preferred embodiments given below, serve to explain the principles of the present invention in which:

FIG. **1** is a block diagram showing a constitution of an interactive communication system according to a first embodiment of the present invention;

FIG. **2** is a block diagram showing a general constitution of a data superimposing broadcast apparatus according to the first embodiment of the present invention;

FIG. **3** is a block diagram showing a general constitution of an information terminal;

FIG. **4** schematically shows a layer structure of the information terminal;

FIG. **5** is a flow chart showing a part of a basic operation of an asymmetric router;

FIG. **6** is a flow chart showing a part of a basic operation of the data superimposing broadcast apparatus;

FIG. **7** is a flow chart showing a part of a basic operation of the information terminal;

FIG. **8** is a flow chart showing the operation of the interactive communication system according to the first embodiment;

FIG. **9** is a block diagram showing a constitution of an interactive communication system according to a second embodiment of the present invention;

FIG. **10** is a block diagram showing a constitution for realizing an encryption processing so as to transmit the data to a specific information terminal alone;

FIG. **11** is a block diagram showing a constitution of the information terminal comprising a conventional personal computer and the like;

FIG. **12** is a block diagram showing a general constitution of the information terminal and the asymmetric router according to a fourth embodiment;

FIG. **13** schematically shows a data format broadcasted by the data superimposing broadcast apparatus according to a sixth embodiment of the present invention; and

FIG. **14** schematically shows the operation in case of using a directional antenna according to a seventh embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

A preferred embodiment of an interactive communication system according to the present invention will now be described with reference to the accompanying drawings.

Embodiments according to the present invention will be described below as an embodiments applied to internet and a value added network (VAN).

(A) First Embodiment

(A-1) Constitution of an Interactive Communication System

FIG. **1** is a block diagram showing a constitution of an interactive communication system according to a first embodiment of the present invention. In FIG. **1**, an information terminal **1** is carried by a user (not shown). The information terminal **1** comprises a key input device (not shown) for inputting an instruction from the user, a display device for displaying various data (image, character and the like) and the like. Furthermore, the information terminal **1** comprises a transmission/reception function for transmitting/receiving the data between the transmission/reception function and an interactive radio network **2** described below and a broadcast reception function for receiving the data from a data superimposing broadcast apparatus **3**. The information terminal **1** carries out a usual interactive communication with the interactive radio network **2**, whereby the information terminal **1** transmits/receives, via the interactive radio network **2**, the data (small amount) such as a command, to/from a server **6** on an internet **5** and a value added network **8** on a fixed network **7** described above. Furthermore, the information terminal **1** receives the data (large amount) from the server **6** on internet **5** and the value added network **8** on the fixed network **7** via the data superimposing broadcast apparatus **3**.

The interactive radio network **2** is a radio network which can perform the interactive communication with the information terminal **1** by radio. For example, the interactive radio network **2** is a communication network formed of base stations provided for each area which can be covered with a radio signal of a predetermined output level such as the communication network for a portable telephone, a PHS and the like. The interactive radio network **2** transmits the small amount data received from the information terminal **1** by radio to an asymmetric router **4** described later. Furthermore, the interactive radio network **2** transmits the small amount data from the asymmetric router **4** to the information terminal **1** by radio.

The data superimposing broadcast apparatus **3** is only unidirectional (transmitting). The data superimposing broadcast apparatus **3** is an apparatus for superimposing a predetermined large amount data from the asymmetric router **4** to a usual broadcasting signal and for transmitting the broadcasting signal. For example, the data superimposing broadcast apparatus **3** is a television broadcasting station for superimposing the large amount data provided from the asymmetric router **4** to the television signal such as a character broadcast and for broadcasting the television signal from a broadcasting tower or antenna (not shown). The data superimposing broadcast apparatus **3** may be a usual analog television broadcasting station or may be a digital television broadcasting station adopted in Europe as described above.

The asymmetric router **4** transmits the small amount data transmitted from the interactive radio network **2** to a predetermined server **6** on internet (a private line or an analog line) **5** described below and to the value added communication network **8** via the fixed network (the private line or the analog line) **7**. The asymmetric router **4** transmits the large amount data transmitted from the server **6** on internet **5** and the value added communication network on the fixed network **7** to the data superimposing broadcast apparatus **3**.

Internet **5** is the communication network in which computers (servers) of various organizations and individuals all over the world are connected to one another. Internet **5** is directly connected to the asymmetric router **4** or is connected to the asymmetric router **4** through the private line or the usual analog line via a provider. The server **6** is a WWW (World Wide Web) server (hereinafter referred to as a Web server) for providing an HTML formatted data (a document comprising the image, a sound and the character) and the server for providing various news and data. Furthermore, the fixed network **7** is the private line or the analog line connected to the value added network **8** for providing various information, and it is directly connected to the asymmetric router **4**.

(A-2) Data Superimposing Broadcast Apparatus

FIG. **2** is a block diagram showing a general constitution of the data superimposing broadcast apparatus **3**. The data superimposing broadcast apparatus **3** comprises a memory **3***a* for temporarily storing the large amount data transmitted from the asymmetric router **4** and a superimposing apparatus **3***b* for superimposing the large amount data stored in the memory **3***a* to the television signal at a predetermined timing (scheduled time of broadcasting) and for transmitting the television signal. If the asymmetric router **4** issues a data transmission request, the data superimposing broadcast apparatus **3** supplies data indicating an idle channel to the asymmetric router **4**, temporally stores the received large amount data in the memory **3***a*, and determines the scheduled time of broadcasting for transmitting the large amount data to the information terminal **1** according to a data amount and the transmission request. Then, the data indicating scheduled time of broadcasting is returned to the asymmetric router **4**. At the scheduled time of broadcasting, the large amount data stored in the memory **3***a* is superimposed to the television signal by the superimposing apparatus **3***b* and is transmitted.

In order to determine the scheduled time of broadcasting, for example, a FIFO system for transmitting the data in an order of the previously received data and such a system that a priority order is combined to this order so as to determine a transmission order are preferable. Furthermore, when a simulcast is previously scheduled, the scheduled time of broadcasting may be determined to avoid the simulcast timing. Furthermore, the data stored in the memory **3***a* is prepared for a re-transmission, and the data is maintained even after the transmission. The data is erased when an ACK signal transmitted from the information terminal **1** is received via the asymmetric router **4** or a predetermined time passes.

(A-3) Information Terminal

FIG. **3** is a block diagram showing a general constitution of the information terminal. The information terminal **1** has an interactive transmitting/receiving circuit **1***a* for transmitting/receiving the data relative to the interactive radio network **2** and a broadcast receiving circuit **1***b* for receiving the television signal from the data superimposing broadcast apparatus **3**. According to the scheduled time of broadcasting which is previously transmitted via the interactive radio network **2**, the information terminal **1** is operated in such a manner that a reception preparation and a data selection are carried out. The broadcast receiving circuit **1***b* is in a sleep state in order to reduce power consumption at a time zone except for a receiving operation. Based on the time measured by a timer **1***e*, the broadcast receiving circuit

1*b* is started by a control circuit If. The broadcast receiving circuit 1*b* is operated so as to receive the television signal to which the large amount data is superimposed. Furthermore, this starting control may include a function of specifying a reception frequency (channel).

A data selecting circuit 1*c* selects the data received by either the interactive radio network **2** or the data superimposing broadcast apparatus **3** under the control of the control circuit 1*f*, and it transmits the data to a processing apparatus 1*d*. The processing apparatus 1*d* processes the supplied data, and the data is converted to a predetermined display format data, so that the data is displayed in a display device 1*h*.

Based on a system clock (not shown), the timer 1*e* measures a present time, and it transmits data indicating the present time to the control circuit 1*f*. The control circuit 1*f* controls each of the above circuits/devices. Furthermore, the control circuit if compares the present time with the scheduled time of broadcasting which is received via the interactive radio network **2**. When the scheduled time of broadcasting comes, the broadcast receiving circuit 1*b* starts operation so that the television signal to which the large amount data transmitted from the data superimposing broadcast apparatus **3** is superimposed is received.

Furthermore, a key input device 1*g* includes a keyboard for accessing internet **5**, for accessing the value added network **8** and for giving various instructions to the control circuit 1*f*. Furthermore, the display device 1*h* comprises, for example, a liquid crystal display device. The display device 1*h* displays a home page provided on internet **5** and the information of the value added network **8**. As the display device 1*h*, such a display device as a CRT may be externally connected.

(A-4) Layer Structure of the Information Terminal

FIG. **4** is a schematic diagram showing a layer structure of the information terminal **1**. The information terminal **1** comprises a physical layer **10** relative to the interactive radio network **2**, a data link layer **11**, a network layer **12**, further, a physical layer **13** relative to the data superimposing broadcast apparatus **3**, a data link layer **14**. The information terminal **1** further comprises an asymmetric routing layer **15** which is over the network layer **12** and the data link layer **14**, and an application layer **16** which is over the asymmetric routing layer **15**. The application layer **16** is a Web browser (software), for example, in case of accessing internet **5**. Since a routing (switching) between the interactive radio network **2** and the data superimposing broadcast apparatus **3** is carried out by the asymmetric routing layer **15**, when a receiver is to be selected, it is not necessary for the application layer **16** to recognize a plurality of receivers.

(B) Operation of the First Embodiment

A part of a basic operation of the asymmetric router **4**, the data superimposing broadcast apparatus **3** and the information terminal **1** will be described. FIGS. **5** to **7** are flow charts showing a part of the basic operation of the asymmetric router, the data superimposing broadcast apparatus **3** and the information terminal **1**, respectively.

(B-1) Asymmetric Router

A procedure of selecting a channel of a downlink in the asymmetric router **4** will be described with reference to FIG. **5**. When the asymmetric router **4** receives the data (large amount or small amount), at step **S10**, the amount of the received data is calculated. It is determined, a step **S12**, whether or not the total amount of the data is larger than a preset value. The preset value is a threshold value for determining whether the data to be transmitted to the information terminal **1** should be transmitted by the data superimposing broadcast apparatus **3** or by the interactive radio network **2**. When the data has the large amount, it is more effective to transmitted via the data superimposing broadcast apparatus **3** having a relatively high-speed data transfer rate. When the data has the small amount, it is more effective to transmitted via the interactive radio network **2** having a relatively low-speed data transfer rate. Therefore, when the total amount of the data is the preset value or less, the process proceeds to step **S14**. At step **S14**, the data is transmitted to the information terminal **1** via the interactive radio network **2**.

When the total amount of the data is larger than the preset value, the process proceeds to step **S16**. At step **S16**, the transmission request is transmitted to the data superimposing broadcast apparatus **3**. At step **S18**, it is determined whether or not the transmission is possible based on a response from the data superimposing broadcast apparatus **3**. For example, the transmission request specifies the channel by which the data should be transmitted. When the transmission is possible, data indicating the channel by which the data should be transmitted is returned. When the transmission is impossible, the process proceeds to step **S14**. The data is transmitted to the information terminal **1** via the interactive radio network **2**.

When the transmission is possible, the process proceeds to step **S20**. At step **S20**, the data is transmitted via the data superimposing broadcast apparatus **3**. When the data superimposing broadcast apparatus **3** receives the data, the scheduled time of broadcasting is determined based on a data amount, and the data is returned to the asymmetric router **4**. At step **S22**, the asymmetric router **4** receives the scheduled time of broadcasting. At step **S24**, data transmission channel and the scheduled time of broadcasting are supplied to the information terminal **1** via the interactive radio network **2**.

At step **S26**, it is waited that the ACK signal indicative of a completion of a data reception is supplied from the information terminal **1** via the interactive radio network **2**. When the ACK signal is received, the received ACK signal is transmitted to the data superimposing broadcast apparatus **3** at step **S28** and then the process is completed.

(B-2) Data Superimposing Broadcast Apparatus

A broadcasting procedure of the downlink in the data superimposing broadcast apparatus will be described with reference to FIG. **6**. When the data superimposing broadcast apparatus **3** receives the data from the asymmetric router **4**, the data is temporally stored in the memory 3*a* at step **S30**. At step **S32**, the received data amount is calculated. At step **S34**, the scheduled time of broadcasting is determined based on the obtained data amount. The scheduled time of broadcasting is transmitted to the asymmetric router **4**.

At step **S38**, it is determined whether or not the scheduled time of broadcasting comes. If the scheduled time of broadcasting is not reached, step **S38** is repeated, and it is in a waiting mode. When it is the scheduled time of broadcasting, the process proceeds to step **S40**. At step **S40**, the data stored in the memory 3*a* at step **S30** is superimposed on an empty portion of the usual television signal and it is broadcasted. At step **S42**, it is determined whether or not the ACK signal from the asymmetric router **4** is received. The ACK signal is a confirmation signal indicative of receiving the whole data transmitted to the asymmetric router **4** by the information terminal **1** receiving the television signal to which the data is superimposed. The ACK signal is transmitted to the data superimposing broadcast apparatus **3** via the asymmetric router **4**.

If the ACK signal from the asymmetric router **4** is not received, the process proceeds to step **S44** in which it is determined whether or not it is time out. If not, the process

is returned to step S42 in order to wait until the ACK signal is received. When the ACK signal cannot be received after a superimposing broadcast of the data, it is time out. In this case, the process proceeds to step S46, and a not-received notification is transmitted to the asymmetric router 4 in order to notify that the information terminal 1 cannot receive the data.

After the superimposing broadcast of the data, when the ACK signal is received from the information terminal 1 via the asymmetric router 4 at step S42, it can be determined that the data is received by the information terminal 1. The process proceeds to step S48 in which the broadcasted data is erased from the memory 3*a*. Then, the process is completed.

(B-3) Information Terminal

The procedure of selecting a reception path in the information terminal will be described with reference to FIG. 7. At step S50, the information terminal 1 determines whether a scheduled channel is the interactive radio network 2 or the data superimposing broadcast apparatus 3. When the scheduled channel is the interactive radio network 2, the process proceeds to step S52. The interactive transmitting/receiving circuit (receiving circuit) 1*a* being a receiving function of the interactive radio network 2 is selected and it is started. At step S54, the small amount data is received from the interactive radio network 2.

When the scheduled channel is the data superimposing broadcast apparatus 3, the process proceeds to step S56. The broadcast receiving circuit 1*b* being the receiving function of the data superimposing broadcast apparatus 3 is selected. At step S58, the channel to be broadcasted notified from the asymmetric router 4 is set. At step S60, with reference to the present time of the timer 1*e*, it is determined whether or not the scheduled time of broadcasting notified from the asymmetric router 4 comes. If the scheduled time of broadcasting is not reached, step S60 is repeated, and it is in the waiting mode. When the scheduled time of broadcasting comes, the process proceeds to step S62. The sleep of the broadcast receiving circuit 1*b* is released. At step S64, the television signal from the data superimposing broadcast apparatus 3 to which the data is superimposed is received.

When the reception of the data superimposed to the television signal is completed, the broadcast receiving circuit 1*b* is returned to the sleep state at step S66. At step S68, after the ACK signal indicative of the completion of the data reception is transmitted to the asymmetric router 4 via the interactive radio network 2, the process is completed.

(B-4) Whole Operation

A whole operation of the first embodiment will be described. FIG. 8 is a sequence for explaining the operation of the interactive communication system according to the first embodiment. When the transmission request is transmitted from the Web browser to the Web server 6 on internet 5, the information terminal 1 transmits a command CMD to the asymmetric router 4 via the interactive radio network 2. The asymmetric router 4 transmits the command CMD to the Web server 6 via internet 5. According to the received command CMD, the Web server 6 transmits, for example, a browser data (an HTML formatted file) D1 to the asymmetric router 4 via internet 5.

When a data amount of the browser data D1 transmitted from the Web server 6 exceeds a predetermined amount, the asymmetric router 4 transmits a channel requirement CRQ to which the browser data D1 should be transmitted to the data superimposing broadcast apparatus 3. The data superimposing broadcast apparatus 3 returns data indicating the idle channel and the ACK signal to the asymmetric router 4. When the asymmetric router 4 receives the ACK signal, the browser data D1 is transmitted to the data superimposing broadcast apparatus 3. When the data superimposing broadcast apparatus 3 receives the browser data D1, the scheduled time of broadcasting is determined in accordance with the data amount. The scheduled time of broadcasting is transmitted to the asymmetric router 4 as a time tag TT.

When the asymmetric router 4 receives the time tag TT, data indicating a previously received transmitting channel C and the time tag TT are transmitted to the information terminal 1 via the interactive radio network 2. The information terminal 1 receives the data indicating data transmission channel C and the time tag TT by the interactive transmitting/receiving circuit 1*a*. According to the time tag TT, the information terminal 1 waits until the television signal to which the browser data D1 is superimposed is transmitted.

When the scheduled time of broadcasting comes, the data superimposing broadcast apparatus 3 superimposes the browser data D1 to the television signal of the preset transmitting channel C by using the superimposing apparatus 3*b*, so that the television signal is transmitted. Similarly, when the scheduled time of broadcasting comes, the information terminal 1 starts the broadcast receiving circuit 1*b*. The television signal to which the browser data D1 is superimposed is received by the started broadcast receiving circuit 1*b*. The browser data D1 is extracted from the television signal. A predetermined formatted display data is generated. The data is displayed in the display device 1*h*. Furthermore, the information terminal 1 transmits the ACK signal indicative of the reception completion of the browser data D1 to the interactive transmitting/receiving circuit 1*a*. The ACK signal is transmitted to the asymmetric router 4 via the interactive radio network 2 by the interactive transmitting/receiving circuit 1*a*. When the asymmetric router 4 receives the ACK signal, the ACK signal is transmitted to the data superimposing broadcast apparatus 3. The data superimposing broadcast apparatus 3 erases the browser data D1 stored in the memory 3*a*.

In such a manner, according to the first embodiment, a data stream (the small amount data such as the command) in an upstream direction relative to the information terminal 1 is transmitted via the interactive radio network 2 whose data transfer rate is relatively low. On the other hand, a data stream (the large amount data such as the browser data) in a downstream direction relative to the information terminal 1 is transmitted by the data superimposing broadcast apparatus 3 whose data transfer rate is relatively high. Therefore, a load of the relatively low-speed interactive radio network 2 is reduced, and further the data can be transmitted at a high speed.

(C) Second Embodiment

A second embodiment of the present invention will be described. According to the second embodiment, among a plurality of data superimposing broadcast apparatuses, the data superimposing broadcast apparatus in which a present position of the information terminal 1 is defined as a service area (radio wave arriving area) is selected. The television signal to which the large amount data is superimposed is transmitted from the selected data superimposing broadcast apparatus. Furthermore, when the data amount to be transmitted exceeds the amount which the data superimposing broadcast apparatus 3 can broadcast, the large amount data is transmitted via the interactive radio network 2. The constitution and the operation of the second embodiment will be described below.

FIG. 9 is a block diagram showing the constitution of the interactive communication system according to the second

embodiment of the present invention. The same portions as those of the first embodiment will be indicated in the same reference numerals and their detailed description will be omitted. An asymmetric router **20** comprises a memory **20***a* for temporally storing the large amount data received via internet **5** or the fixed network **7**. The large amount data is usually provided for any one of data superimposing broadcast apparatuses **3-1**, **3-2**, . . . , 3-n. The data is transmitted to the information terminal **1** by the data superimposing broadcast apparatus 3-i (i=1 to n). However, when the data amount to be transmitted exceeds the amount which the data superimposing broadcast apparatus **3**-i can broadcast, the large amount data must be transmitted via the interactive radio network **2**. In this case, since the interactive radio network **2** has a relatively low data transfer rate, the large amount data is needed to be temporally stored. As described above, when the data amount cannot be transmitted by the data superimposing broadcast apparatus **3**-i, the memory **20***a* of the asymmetric router **20** is used for transmitting via the interactive radio network **2**.

Furthermore, each of the data superimposing broadcast apparatuses **3-1** to 3-n is provided in each region to which a predetermined outputted broadcast wave can arrive. The large amount data is superimposed to the television signal and broadcasted by the apparatus in which the present position of the information terminal **1** is defined as the service area. The asymmetric router **20** obtains the present position of the information terminal **1** via the base stations provided in each predetermined area in the interactive radio network **2**. The asymmetric router **20** selects based on the obtained present position of the information terminal **1** to which the data superimposing broadcast apparatuses **3-1** to 3-n the large amount data is supplied. The asymmetric router **20** is previously provided with a correspondence as a table between the present position of the information terminal **1**, that is, the area where the information terminal **1** exists which is obtained via the base station and the data superimposing broadcast apparatus **3** in which the area is defined as the service area.

(D) Operation of the Second Embodiment

When the asymmetric router **20** receives the command for a connection requirement to the Web server **6** on internet **5** from the information terminal **1** via the interactive radio network **2**, the command is transmitted to the Web server **6** via internet **5**. When the command is received, a position information indicative of the present position of the information terminal **1** is obtained. When the data (browser data) of large amount transmitted from the Web server **6** on internet **5** is received, the asymmetric router **20** temporarily stores the received browser data in the memory **20***a*.

Based on the position information of the information terminal **1**, the asymmetric router **20** requires for the channel by which the browser data is transmitted to the corresponding data superimposing broadcast apparatus **3**-i among the data superimposing broadcast apparatuses **3**-i to 3-n. When data transmission to the corresponding data superimposing broadcast apparatus **3**-i is possible, the browser data which is temporarily stored in the memory **20***a* is transmitted to the corresponding data superimposing broadcast apparatus **3**-i in the same way as the first embodiment. Thereafter, similarly to the first embodiment, the data superimposing broadcast apparatus **3**-i superimposes the browser data to the television signal and it broadcasts the signal at a predetermined scheduled time of broadcasting.

When data transmission to the corresponding data superimposing broadcast apparatus **3**-i is impossible, the asymmetric router **20** notifies the information terminal **1** that the interactive radio network **2** should be used to transmit the browser data. Thereafter, the browser data which is temporarily stored in the memory **20***a* is transmitted to the information terminal **1** via the interactive radio network **2**. According to the notification from the asymmetric router **20**, as shown in the flow charts of FIGS. **5–7**, the information terminal **1** sets the reception path in the interactive radio network **2**. The interactive transmitting/receiving circuit **1***a* receives the browser data. A display data is generated from the browser data. The display data is displayed in the display device **1***h*. When the asymmetric router **20** receives the ACK signal indicative of the reception completion of the browser data from the information terminal 1, the browser data in the memory **20***a* is erased.

As described above, according to the second embodiment, the large amount data is superimposed to the television signal and broadcasted (transmitted) by the data superimposing broadcast apparatus **3**-i alone in which the present position of the information terminal **1** is defined as the service area among the plural data superimposing broadcast apparatuses **3**-i to 3-n. Therefore, a resource of the radio wave can be effectively used. Furthermore, if there is no data superimposing broadcast apparatus which can transmit the data, the large amount data is temporarily stored in the memory **20***a* provided in the asymmetric router **20**. The data stored in the memory **20***a* is transmitted to the information terminal **1** via the interactive radio network **2**. Therefore, even if the data superimposing broadcast apparatus is occupied, it is not necessary to wait for a long time, and the large amount data can be received.

(E) Third Embodiment

A third embodiment of the present invention will be described. According to the third embodiment, in order that the data (the small amount and the large amount) may be transmitted/received between specific information terminals alone, the data is encrypted so as to be transmitted/received.

FIG. **10** is a block diagram showing a constitution for realizing an encryption processing so as to transmit the data to the specific information terminal alone. The same portions as those of the first embodiment will be indicated in the same reference numerals and their detailed description will be omitted. A certifying center **30** has an inherent encrypting key K for the asymmetric router **4**, and the encrypting key K is supplied to the asymmetric router **4**. The asymmetric router **4** encrypts the large amount data to the data superimposing broadcast apparatus **3** by using the encrypting key K. Based on the request from the information terminal **1**, the asymmetric router **4** transmits the encrypting key K to the information terminal **1** via the interactive radio network **2**.

An encrypting/decrypting portion **31** includes an inherent encrypting key K1 for the interactive radio network **2**. The encrypting key K1 is supplied to the interactive radio network **2**. The interactive radio network **2** uses the encrypting key K1, so that the small amount data between the information terminals is encrypted and decrypted.

The information terminal **1** comprises an encrypting/decrypting portion **1***i* for encrypting/decrypting the small amount data to be transmitted/received between the information terminal **1** and the interactive radio network **2** by using the encrypting key K1. Furthermore, the information terminal **1** comprises a decrypting portion **1***j* for decrypting the large amount data from the data superimposing broadcast apparatus **3** by using an encrypting key K2 obtained from the asymmetric router **4** via the interactive radio network **2**.

It is assumed that the interactive radio network **2** encrypted by the encrypting key K1 being a safe path can be

used. The certifying center **30**, preferably, uses "One Time Pad encryption system" using the time tag and the like, as the encryption system. The "One Time Pad encryption system" always generates the encrypting key for encrypting/decrypting. Furthermore, the encrypting key is used only once, and the same encrypting key is not used repeatedly. That is, whenever the data necessary for the encryption is generated, the encrypting key K2 is generated. The encrypting key K2 is used so that the data superimposing broadcast is encrypted. Thereafter, the encrypting key K2 is transmitted to the information terminal **1** via the interactive radio network **2**, and the same-valued encrypting key K2 is never used.

According to the third embodiment, the data to be transmitted/received is encrypted between the asymmetric router **4** and the data superimposing broadcast apparatus **3**, between the interactive radio network **2** and the information terminal **1** and between the data superimposing broadcast apparatus **3** and the information terminal **1**, whereby the data can be safely transmitted. Furthermore, since the data can be received by the information terminal **1** which is previously authorized by the certifying center **30**, for example, a charge management for each information terminal can be realized, which is very effective for providing a service.

(F) Fourth Embodiment

A fourth embodiment of the present invention will be described. According to the fourth embodiment, the constitution for reducing the load of the information terminal is provided. In general, for example, in case of accessing the Web server **6** on internet **5**, in a general personal computer (or the terminal for accessing internet), for example, the Web browser is implemented on an OS environment such as Windows (trademark), whereby the access can be realized. However, in this case, since a sufficient memory amount and a high-speed processing are needed, a cost of the terminal is increased. Furthermore, a circuit constitution becomes complicated and large-scaled, so that portability is lost.

FIG. **11** is a block diagram showing the constitution using the terminal such as a conventional personal computer. An input/output apparatus **40** is a display (a liquid crystal display and the like) and a mouse/keyboard (which may be a cursor key and a track ball provided in a housing). A mouse driver **41** and a display driver **42** on the OS control the input/output apparatus **40**. A Web browser **43** is application software operated under the OS. The Web browser **43** generates the predetermined format display data from the browser data. The Web browser **43** displays the data in the display device by using the display driver **42**. The Web browser **43** receives the input signal from the mouse/keyboard operated by the user.

Furthermore, at the access to internet **5**, the Web browser **43** transmits a specification (command) of a browsing page, the instruction (command) to download a program assigned to the page and the like to a communication driver **44**. The communication driver **44** is software on the OS. The communication driver **44** controls a modem **45** (or an Ethernet card and the like), and it transmits the command to internet **5**. In some cases, the connection to internet **5** is carried out via a fire wall **46** such as a Proxy server. The fire wall **46** is a security software for preventing an external invasion (access) to the information terminal **1**. According to the information terminal comprising the conventional constitution, in addition to the OS, the software of large amount such as the Web browser must be started. Therefore, the memory amount and a processing rate are limited, so that it is difficult to realize a comfortable environment.

According to the fourth embodiment, the asymmetric router **4** carries out the processing of the Web browser, and the information terminal **1** carries out only an input/output processing. The fourth embodiment will be described in detail below. FIG. **12** is a block diagram showing a general constitution of the information terminal and the asymmetric router according to the fourth embodiment. The same portions as those of the first embodiment (FIG. **3**) will be indicated in the same reference numerals and their detailed description will be omitted.

The display device **1***h* is the display device comprising the liquid crystal display device and the like, as described above. The predetermined format display data (the large amount data: the browser data, the small amount data: the command) supplied via an input/output driver **52** is displayed. A touch screen sensor **50** is a sensor for sensing a touch on a screen of the display device **1***h* by the user. A touched position is supplied to a quick pointer **51**. According to the touched position from the touch screen sensor **50** and a display screen information of the display device **1***h*, the quick pointer **51** obtains which position is touched on the display screen (position information). The position information is supplied to a communication driver **53** via the input/output driver **52**.

The communication driver **53** supplies the position information as the command to the interactive transmitting/receiving circuit **1***a*. On demand, the communication driver **53** may supply an ID number **55** for identifying the information terminal **1** to the interactive transmitting/receiving circuit **1***a*. A communication port selector **54** selectively switches the small amount data supplied from the interactive radio network **2** via the interactive transmitting/receiving circuit **1***a* or the large amount data (browser data) from the data superimposing broadcast apparatus **3** received by the broadcast receiving circuit **1***b*. The data is supplied to the display device **1***h* via the input/output driver **52**.

In the asymmetric router **4**, an input/output ID driver **56** shown in FIG. **12** receives the data and the ID number transmitted from the information terminal **1** via the interactive radio network **2**. Referring to a correspondence table **57** which stores a correspondence between the ID number and an address of internet, the data is transmitted to a Web browser **58**. Furthermore, the large amount data (such as the browser data) received by the Web browser **58** is supplied to the data superimposing broadcast apparatus **3**. As described above, the Web browser **58** is the software for accessing internet **5**. According to the data from the input/output ID driver **56**, the Web browser **58** accesses a predetermined server **6** on internet **5**. Furthermore, the connection to internet **5** may be carried out via a fire wall **59** such as the Proxy server as usual.

According to the fourth embodiment, the asymmetric router **4** comprises the software for accessing internet **5**. The information terminal **1** comprises the software alone for the input/output processing. Therefore, the load of the memory amount and the processing rate in the information terminal **1** can be reduced, so that the apparatus can be used in the comfortable environment. Thus, the user can access the server **6** on internet **5** by the inexpensive and light weight information terminal **1**. Furthermore, by the information terminal which does not have the address of internet **5**, the user can access the server **6** on internet **5**.

(G) Fifth Embodiment

A fifth embodiment of the present invention will be described. According to the fifth embodiment, as the interactive radio network **2**, a plurality of interactive radio networks such as the PHS which can provide the service in a predetermined area and a cellular telephone (portable telephone) which can provide the service almost all over the

area can be used. Based on the present position of the mobile information terminal **1**, the available interactive radio network can be selected.

The fifth embodiment comprises the same as the second embodiment. A radio network identification data indicative of the available interactive radio network in the corresponding area is superimposed to each television signal transmitted from a plurality of data superimposing broadcast apparatuses provided in each area. When the information terminal **1** is moved to another area, it is confirmed the radio network identification data superimposed to the television signal received at a place to which the information terminal **1** is moved. Therefore, the available interactive radio network can be selected in the present area.

Furthermore, when the information terminal **1** is moved, a fact that the television signal can be received at the place to which the information terminal **1** is moved may be notified to the asymmetric router **4** via the interactive radio network **2**. Therefore, the asymmetric router **4** can interactively transmit/receive the data relative to the information terminal **1** via the notified interactive radio network **2**.

Furthermore, the above two systems may be combined to each other. The radio network identification data indicative of the available interactive radio network **2** in the corresponding area is superimposed to each television signal transmitted from a plurality of data superimposing broadcast apparatuses. A fact that the moved information terminal **1** can receive the television signal may be notified to the asymmetric router **4** via the interactive radio network **2** indicated by radio network identification data which is superimposed to the television signal and is broadcasted.

According to the fifth embodiment, even if the information terminal **1** is moved and it is moved to the service area for the different interactive radio network **2** and data superimposing broadcast apparatus **3**, the appropriate interactive radio network **2** can be selected based on the present position of the information terminal **1**. Therefore, it is possible for the information terminal **1** to move over a wide range.

(H) Sixth Embodiment

A sixth embodiment of the present invention will be described. According to the sixth embodiment, the data format broadcasted by the data superimposing broadcast apparatus **3** comprises the constitution shown in FIG. **13**, so that a finer service is provided. In FIG. **13**, a frame **60** comprises a preamble/time marker **70**, a signal distribution code (length of each data) **71**, a data **80** related to an individual user, a data **90** related to a group user and a public data **100**.

The length of one frame **60** is variable so that the length of each data can be flexibly set. In order to reduce the power consumption, the frame **60** comprises a periodical time marker. According to the time marker, a flexible frame constitution is realized. The signal distribution code **71** specifies a distribution of each length of the data **80** related to the individual user, the data **90** related to the group user and the public data **100**. The signal distribution code **71** is encoded.

The data **80** related to the individual user is encrypted so that a specific individual can decrypt the encrypted data by the key which is specified by an individual ID of the individual. A detail of the encryption is described in the third embodiment. The data **90** related to the group user is encrypted so that a common group can decrypt the encrypted data by the key specified by a group ID of the group. The data **90** related to the group user comprises a preamble **90***a* at the head thereof. The public data **100** is not encrypted so that many and unspecified receivers (information terminals) can freely receive the data. Similarly to the data **90** related to the group user, the public data **100** comprises a preamble **100***a* at the head thereof.

The individual ID may be different from the group ID. The group ID may be embedded into a predetermined position of the individual ID. In an embedding form, for example, the ID form is defined as "AAAABB", the former "AAAA" is used for the individual ID for identifying the individual, and the latter "BB" is used for the group ID for identifying the group.

According to the sixth embodiment, the data which is superimposed to the television signal and transmitted from the data superimposing broadcast apparatus **3** is formed by the data **80** related to the individual user, the data **90** related to the group user and the public data **100**, whereby the broadcast-authorized user can be flexibly set. The data **80** related to the individual user and the data **90** related to the group user are encrypted so that the broadcast-authorized user alone can decrypt the data, whereby a leakage of the information can be prevented. Furthermore, the time marker **70** is added, so that the information terminal **1** starts the reception by matching to a reception timing. Therefore, at the time except for the reception timing, the information terminal **1** is in the sleep state, whereby the power consumption can be reduced.

(I) Seventh Embodiment

A seventh embodiment of the present invention will be described. According to the seventh embodiment, in the data superimposing broadcast apparatus **3**, a plurality of directional antennas directed in different directions are used, whereby radio waves of a common frequency can be used for each antennas, so that the data related to respective users are simultaneously transmitted to a plurality of users. As described in the sixth embodiment, in data transmission of the data related to the individual user, in order to communicate with the specific individual user via the interactive radio network **2**, the service area corresponding to the base station number is known, so that the position of the individual user can be specified.

When the large amount data is simultaneously transmitted to a plurality of individual users, a plurality of directional antennas directed in different directions are used for the data superimposing broadcast apparatus **3**. Therefore, if a plurality of individual users are sufficiently separated from one another in a direction which can sufficiently ensure a CIR (Carrier-to-Interference Ratio) by a directivity of the antenna, the different data can be simultaneously transmitted to the corresponding user by the common frequency.

FIG. **14** schematically shows the operation in case of using the directional antenna according to the seventh embodiment. In FIG. **14**, a reference symbol Z denotes the service area of the broadcast by the data superimposing broadcast apparatus **3**. Reference symbols **A1**, **A2**, **A3** are the service areas of the broadcast by respective base stations of the interactive radio network **2**. That is, a plurality of base stations exist in the service area Z of the broadcast by one data superimposing broadcast apparatus **3**. The interactive radio network **2** is formed of a plurality of base stations. A plurality of base stations of the interactive radio network **2** may be overlapped on the service area by the different data superimposing broadcast apparatus **3**. Furthermore, reference numbers **110**, **111**, **112**, **113**, **114** denote boundaries of the directivity of each directional antenna of the data superimposing broadcast apparatus **3**, respectively.

The directivity of the individual user accessing the Web server **6** on internet **5** in the service area A1 may be overlapped on that of the individual user accessing in the

service area A2. Therefore, although it is difficult to ensure a sufficient CIR, there is a possibility that the directivity of the user in the service area A1 may be separated from that of the user in the service area A3 by a sufficient directivity. In this case, the corresponding different data can be transmitted from the antennas corresponding to each service area to the individual user in the service area A1 and the individual user in the service area A3, respectively, with the same frequency at the same time. The individual user in the service area A1 and the individual user in the service area A3 can simultaneously receive the corresponding data.

When the data is transmitted to the individual user in the service area A1 alone, the directional antenna limited by the directional boundaries **110** and **111** is used, whereby it is not necessary to transmit the radio wave in any other unnecessary directions, so that a radio wave resource can be effectively used. Furthermore, since an unnecessary radio wave is not outputted, interference between the radio waves can be reduced.

According to the above embodiments, although only the browser data of internet **5** is described above, the present invention is not limited to this. The value-added network **8** is the same as above. For example, the present invention can be applied to a television learning system, news (selection of detailed items), advertisement (requirement of contents explanation), a quiz/game (answer), a questionnaire and the like. Furthermore, if the encryption technique and the individual ID are used, an education system, a home shopping and the like to the specific individual are possible.

As described above, according to the present invention, the following effects can be obtained.

(1) The information terminal can perform the interactive communication. When respective information amounts to be transmitted in up link and down link are asymmetric to each other, i.e., they are different from each other, more specifically, when the down link information amount is larger than the up link information amount, the large amount data is transmitted from means for transmitting the large amount data which can transmit the large amount data. Therefore, data transmission can be so effectively carried out as to make the most of a high speed of the means for transmitting the large amount data, whereby the load applied to the interactive radio network can be reduced.

(2) In the interactive radio network, the base station which interactively transmits/receives the data relative to the information terminal existing in the corresponding service area is located in each predetermined service area. Therefore, as the interactive radio network, for example, existing PHS and cellular telephone (portable telephone) can be used.

(3) Since the large amount data is usually superimposed to the idle area of the television signal to be broadcasted and it is broadcasted, a usual television broadcasting station can be used as the means for transmitting the large amount data.

(4) In the means for transmitting the large amount data, the large amount data to be transmitted is temporarily stored in the memory, whereby the scheduled time of broadcasting can be set according to the data amount of the large amount data. Therefore, a transmitting schedule can be determined. Furthermore, the scheduled time of broadcasting is supplied to the information terminal, whereby the information terminal may operate means for receiving the large amount data during the time zone when the large amount data is transmitted. Therefore, the power consumption can be reduced.

(5) Since appropriate means for transmitting the large amount data can be selected from a plurality of means based on the present position of the information terminal, the radio wave resource can be effectively used.

(6) A predetermined encryption is carried out relative to the data transmitted/received between the information terminal and the interactive radio network and the data transmitted from the mean for transmitting the large amount data to the information terminal. Therefore, the leakage of the information can be prevented. Furthermore, the specific information terminal alone which obtains the encrypting key can receive (decrypt) the data. Therefore, for example, a charged service necessary for the charge management can be provided.

(7) When the server on internet is assumed as information providing means, the asymmetric router comprises browsing means for browsing the information (the large amount data) on the server. The information terminal carried out only such processes as to transmit the command and to display the predetermined format display data. Therefore, the load applied to the memory amount and the processing rate of the information terminal can be reduced. Furthermore, a circuit scale can be reduced. The portability is not lost, and a comfortable usage environment can be provided.

(8) A radio network information indicative of the available interactive radio network in the corresponding service area is transmitted by the means for transmitting the large amount data. Therefore, even if the information terminal is moved to a different service area (a different interactive radio network or different means for transmitting the large amount data), an appropriate system can be selected, and the information terminal can be moved over the wide range.

(9) An identification code for specifying the information terminal is added to the large amount data transmitted by the means for transmitting the large amount data. Therefore, the information terminal can receive only the large amount data related to the information terminal. The leakage of the information can be prevented, and the charged service can be realized.

(10) The means for transmitting the large amount data comprises a plurality of directional antennas having the directivity in different directions. Furthermore, the information terminal supplies the position information indicative of the present position to the means for transmitting the large amount data via the interactive radio network and the asymmetric router at a predetermined timing. Therefore, a number of data can be simultaneously transmitted to a plurality of information terminals with the same frequency. Furthermore, the radio wave resource can be effective used, and a transmitting efficiency can be improved.

Additional advantages and modifications will readily occur to those skilled in the art. Therefore, the present invention in its broader aspects is not limited to the specific details, representative devices, and illustrated examples shown and described herein. Therefore, various modifications may be made without departing from the spirit or scope of the general inventive concept as defined by the appended claims and their equivalents.

We claim:

1. A data communication system comprising:

an interactive communication system in which data is transmitted/received between a host server and a terminal;

a large amount data transmitting system for unidirectionally transmitting a large amount of data from the host server to said terminal; and

a data supplying apparatus for supplying data to be transmitted to said terminal to said interactive communication system when an amount of the data is less than a predetermined amount, and for supplying the data to be transmitted to said terminal to said large amount data

transmitting system when the amount of the data is larger than the preset amount;

wherein said large amount data transmitting system comprises:

(i) storage means for temporarily storing large amount data supplied by the data supplying apparatus;

(ii) a timer for determining a scheduled transmission timing; and

(iii) transmitting means for transmitting the large amount data stored in said storage means to the terminal at the scheduled transmission timing.

2. The communication system according to claim 1, wherein said transmitting means of said large amount data transmitting system comprises a broadcasting system for broadcasting a television signal, and means for superimposing the large amount data to be transmitted to said terminal on said television signal so that the large amount data is broadcasted to the terminal.

3. The communication system according to claim 1, wherein:

said large amount data transmitting system further comprises means for supplying data indicating the scheduled transmission timing to said terminal via said interactive communication system; and

said terminal comprises means for receiving the data indicating the scheduled transmission timing, and means for turning on a receiving circuit at the scheduled transmission timing so that the terminal may receive the large amount data transmitted by said large amount data transmitting system.

4. The communication system according to claim 1, wherein:

said large amount data transmitting system comprises a plurality of data transmitting devices which are located in respective predetermined areas; and

said data supplying apparatus comprises means for detecting a position of the terminal and means for supplying the data to be transmitted to the terminal to a data transmitting device located in an area corresponding to the position of said terminal.

5. The communication system according to claim 1, wherein:

said data supplying apparatus performs a predetermined encryption using a predetermined encrypting key relative-to the large amount data supplied to said large amount data transmitting system; and

said terminal includes means for decrypting encrypted large amount data transmitted by said large amount data transmitting system using the predetermined encrypting key.

6. The communication system according to claim 5, wherein said terminal obtains the predetermined encryption key via said interactive communication system prior to a reception of the encrypted large amount data.

7. The communication system according to claim 1, wherein said interactive communication system and said terminal perform a predetermined encryption using a predetermined encrypting key relative to small amount data to be transmitted/received, and the encrypted small amount data is decrypted using the predetermined encrypting key.

8. The communication system according to claim 1, wherein:

said host server comprises a plurality of internet servers for providing an HTML formatted file; and

said data supplying apparatus browses the HTML formatted file provided by a predetermined internet server according to a command supplied from said terminal via said interactive communication system, and converts the HTML formatted file into display format data which is transmitted to said large amount data transmitting system.

9. The communication system according to claim 4, wherein:

said large amount data transmitting system transmits communication information indicating a type of interactive communication device which can be used in each area by said terminal; and

said terminal selects a specific interactive communication device to be used according to the communication information transmitted by said large amount data transmitting system.

10. The communication system according to claim 1, wherein:

said large amount data transmitting system transmits an identification code for specifying the terminal to receive the large amount data; and

said terminal determines whether or not the identification code provided by said large amount data transmitting system corresponds to a preset identification code of the terminal, and enables the large amount data to be received only if a correspondence is detected.

11. The communication system according to claim 1, wherein:

said terminal supplies position information indicative of a present position of the terminal to said interactive communication system at a predetermined timing;

said data supplying apparatus transmits the position information via said interactive communication system to said large amount data transmitting system; and

said large amount data transmitting system comprises a plurality of transmitting antennas each having a different directivity, so that the large amount data may be selectively transmitted from a given one of the data transmission antennas having a directivity corresponding to said position information.

12. The communication system according to claim 1, wherein said interactive communication system comprises a base station connected to the terminal via a radio channel and a wired network connected between the base station and the host server.

13. The communication system according to claim 1, wherein said interactive communication system comprises means for transmitting a data request from the terminal to the host server.

* * * * *